RAILROAD GAZETTE

FRIDAY, JULY 7.

MASTER MECHANICS' ASSOCIATION.

Reports at the Annual Convention.

We give below some of the reports presented to the Master Mechanics' Association at the recent convention at Niagara Falls:

SECRETARY'S REPORT.

To the American Railway Master Mechanics' Association:

Herewith I present a detailed statement of the Association for the year ending with this our fifteenth annual Convention.

Since last report the following gentlemen have become members of the Association:

A. G. Eastman, Southeastern R. R., Richford, Vt.

W. C. Ennis, New York, Susquehanna & Western, Wortendyke, N. J.

Alex. Gordon, Niles Tool Works, Hamilton, O.

N. W. Howson, Cumberland & Penn., Mt. Savage, Ind.

J. D. Hollister, Savannah, Fla. & West., Savannah, Ga.

William Kent, M. E., Schoenberger & Co., Pittsburgh, Pa.

Lewis F. Lyne, M. E., *American Machinist*, New York city.

J. M. Lewis, Selma & Greensboro, Marion, Ala.

E. Minshall, N. Y., Ontario & Western, Middletown, N. Y.

R. M. Pringle, St. Louis & Cairo, St. Louis, Mo.

John Player, Central Iowa, Marshalltown, Ia.

Henry B. Stone, Chicago, Burlington & Quincy, Aurora, Ill.

William Thaw, Baldwin Locomotive Works, Philadelphia, Pa.

The following members have by the rules of the Association forfeited their membership on account of the non-payment of dues and their names have been stricken from the rolls:

Thomas Anderson, H. V. Faries, R. D. Grant, W. E. Granger, E. O. Hill, A. S. Hull, Thomas Lingle, W. H. Lewis, Jno. McKenzie, Gordon H. Nott, N. Slingland and E. Sleppy.

The following members have resigned:

W. B. Bement, B. L. Baldwin, F. K. Hain, Lyell T. Mead and Warren Noyes.

And since we last met the following members have been called away by death:

Alex. Holley, W. S. Hudson, William Rushton, W. Spittle and H. E. Woods; which changes leave the present membership numbering 188.

Twelve hundred copies of the 14th annual report have been printed; 254 of which have been distributed to members and 331 to railroad companies, locomotive works and others, leaving 615 copies still on hand.

The following is a statement of money received from railroad companies and others contributing to the printing fund:

Seaboard & Roanoke	$5.00
Illinois Central	10.00
Connecticut River	10.00
Boston & Providence	10.00
Lake Shore & Michigan Southern	10.00
Delaware, Lackawanna & Western	10.00
New York, Lake Erie & Western	10.00
East Tenn., Virginia & Georgia	10.00
Mobile & Ohio	10.00
Chicago & Eastern Ill.	10.00
Missouri Pacific	10.00
Lehigh Valley	10.00
Northern (New Hampshire)	10.00
St. Louis, Iron Mountain & Southern	10.00
Boston, Lowell & Concord Line	10.00
Cleveland, Col., Cin. & Indianapolis	10.00
Atchison, Topeka & Santa Fe	10.00
Canada Southern	10.00
Lantern & Steam Gauge Co	50.00
Nathan & Dreyfus, New York	20.00
Rogers Locomotive Works	50.00
Baldwin " "	10.00
Taunton " "	10.00
Schenectady " "	10.00
Pittsburgh " "	10.00
H. K. Porter & Co.	10.00
Niles Tool Works, Hamilton, O.	10.00
W. W. Evans, New York city	10.00
Total amount contributions	$365.00
Received by assessment	730.00
" " initiation	8.00
" " *Railroad Gazette*	50.00
" " Sale of reports, *Railroad Gazette*	22.95
Total amount received	$1,175.95

For which I hold the Treasurer's receipts.

The Boston Fund, consisting of $3,700 in 4 per cent. bonds with accrued interest amounts as follows:

Interest and amount unapplied at last report, including Cleveland donation	$369.51
July interest, 1881	37.00
October interest, 1881	37.00
January interest, 1882	37.00
April interest, 1882	37.00
Total int. and amt. unapplied	$517.51
Which amount added to the principal	3,700.00
Shows the present value of the fund	$4,217.51

In this connection permit me to say just a few words in regard to myself:

With the close of this Convention I will have been your Secretary for 12 years, and I beg you will do me the justice to believe that it is with no ordinary feeling of regret that I say to the members that I shall not again be a candidate for the office of Secretary. I make this known early in the convention that the members may be prepared to unite upon some one to fill the place who will in some degree familiarize himself with the work before the convention closes. As the immmediate custodian of the Boston Fund and other property of the Association, I would say that it is in order and ready to be delivered to my successor.

Very respectfully,

J. H. SETCHEL, Secretary.

EXPERIMENTS WITH THE WOOTTEN FIRE-BOX.

To the American Railway Master Mechanics' Association:

The year that has just passed has been such a busy one for me and has added such an increase to my duties that I have been totally unable to give my attention to the making of any experiments or locomotive tests whatsoever, but in order to add my quota towards keeping the subject before the Associatien I propose to give you a short account of my experience with a Baldwin consolidated engine, having the Wootten fire-box, in the burning of Illinois bituminous coal.

This engine was put to work on the Illinois Division of the Wabash Railway in the latter part of the year 1880, and in December of that year and January of 1881 I made a short series of experiments with it, the results of which I propose to give you, with the hope that they may prove of value to some of the members present and not be lacking in interest to others.

This engine was originally built for the Reading road by the Baldwin Locomotive Works, but for some reason remained on the hands of the Baldwin people, from whom it was purchased by our company.

It had 20 by 24 in. cylinders and possesses the regular Wootten fire-box, the dimensions of which are as follows:

Length 10 ft., width 8 ft., inside, with a combustion chamber 4 ft. in length.

As this engine came fitted up with stationary water grates for burning anthracite coal slack, I deemed it a fine opportunity to ascertain by actual experiment whether any success could be met with in burning Illinois bituminous lump coal, before making any change in the grate arrangement.

For this purpose I fitted the engine up with an arrangement for registering the amount of water used, similar to the one previously explained to the Association in other experiments that I have made, but unfortunately the temperature fell to the lowest point of the year during the first trip, and the formation of ice in the apparatus nullified its use, so that it had to be abandoned.

I was therefore unable to ascertain the amount of water evaporated per pound of coal used, and can only furnish you the pounds of coal consumed per loaded car mile, of which a careful record was kept.

In making the experiment I had the engine make two round trips between Springfield and Danville, a distance of 113 miles, and two round trips between Decatur and Danville, a distance of 74 miles, and will give you in as few words as possible a summary of the results obtained.

Performance of a Baldwin 20 by 24 in. cylinder consolidation engine with Wootten fire-box, in making two round trips between Springfield and Danville, and two round trips between Decatur and Danville, on Dec. 28, 30, 31, 1880, and Jan. 1, 4, 6, 7, and 8, 1881. State of weather stormy and cold with snow, and thermometer ranging from 20 degrees above to 18 degrees below zero. Ruling grade 40 ft. per mile each way.

Total miles run by engine	752 miles
Coal consumed	170,000 lbs.
Loaded car mileage	27,433 miles
Empty car mileage	3,803 "
Total loaded car mileage	29,716 "
(Rating 5 empties as 3 loads.)	
Average train (loaded and empty)	41.5 cars
" " (estimated loaded)	28.2 "
Miles run to 1 ton coal	8.85 miles
Pounds of coal per loaded car mile	5.7 lbs.

As you will observe, the pounds of coal consumed per loaded car mile is exceedingly heavy, but when we take into consideration the heavy snows and stormy condition of the atmosphere, it compares very favorably with the general average of our other engines, most of which are of the regular 16 by 24 in. cylinder 8-wheel type, as the following table will show.

Pounds of coal consumed per loaded freight car mile during the following years and months:

1879	January	4.21 lbs.
	December	3.92 "
1880	January	3.24 "
	December	5.70 "
1881	January	5.20 "
	December	5.50 "

As a result of the foregoing experiment, I found that no difficulty was experienced in burning the Illinois bituminous coal in this class of engine with stationary grates, when fired in the usual way, one fireman being able to manage the fire while running with as much ease and freedom as he could on our other engines. The boiler making steam freely and in abundant quantity to do all the work required.

The chief difficulty we experienced in managing the fire was due to the necessity of drawing the clinkers from the coal through the fire doors when cleaning the fire, which had to be done every 30 or 40 miles while running and at the terminus of each trip.

This difficulty, however, is due to the use of stationary grates and could easily be remedied.

As to the capacity of the engine, we found that coming west from Danville 60 loaded cars was the maximum train this engine could handle on account of the water capacity of the tank being too small for the distance between water stations, the tank holding 4,000 gallons, which clearly indicates the enormous evaporative capacity of the boiler.

On one of the trips the engine took 55 loads over Cerro Gordo and Philo grades, 40 ft. to the mile, cut back to 16 in., and this train could undoubtedly have been started from a dead stop on either one of these grades.

During the experiment the business of the road was such that we could not obtain cars enough to load the engine up to its full capacity, which will account for the low average train. On one of the trips, however, the engine hauled 91 loaded and empty cars, equivalent to 60 loads, and could have handled more had the capacity of tank been sufficient to hold water enough to make the water stations.

On all of the runs the engine made good average freight train time, which with us is 17 miles per hour, did not cause any delay to other trains, and fully kept up to the train-dispatcher's arrangements and calculations.

Considering the very low temperature, ranging from 20 above to 18 below zero, and the stormy state of the weater, during a part of the time accompanied with a driving snowstorm, I think the engine did remarkably well and fully demonstrated that Illinois coal could be used as a fuel in the present shape and condition of the fire-box.

Having placed before you the facts concerning the working of this engine while under my supervison, I have a few remarks to make concerning the general construction of the boiler and fire-box itself.

From my observations of this style of boiler, I am led to believe that it would not prove successful in our service in burning bituminous coal, from the fact that, owing to the peculiar shape of the fire-box and the general construction of the boiler itself, it would unquestionably give a great deal of trouble after a few years usage in the shape of constant attention and repairs.

In fact, during the short time in which the experiments were being made, it was necessary for us to remove the jacket immediately over the fire-box shell twice, in order to caulk the seams, which began to leak so badly as to absolutely require its being done.

The flues also were a continued source of trouble, owing to their leaking very badly, which I account for by the necessity of opening the damper in smoke-box door in order to check the natural draft when the engine was standing still and at the same time steaming too freely.

This allowing cold air to enter the smoke-box is, in my opinion causing a sudden cooling and contraction that is very disastrous to the life of the flues.

Owing to the extra large heating surface, the steaming capacity of the boiler is more than sufficient to supply all the steam that would be required under any circumstances, and as far as this quality is concerned the boiler may be considered as being good.

The irregular shape of the boiler as a whole however, in my opinion renders it liable to excessive straining through its liability of being subjected to extremes in expansion and contraction, which in a comparatively short time would necessitate constant attention and repairs, and the increased cost of caring for this kind of boiler would not be compensated for by the benefits derived from the extra good steaming qualities.

In general construction and arrangement of the machinery, the engine was good and gave no trouble whatsoever.

In conclusion, I will say that in my opinion this class of engine, the consolidation, is the proper engine for through freight service in an economical point of view, owing to the capacity and traction of the engine being so great as to largely increase the size of the train hauled thereby diminishing the train service and expense.

JACOB JOHANN,
General Master Mechanic, W., St. L. & P. Ry.

On Cracks and Annealing of Steel.

The following is a paper read at a recent meeting of the (English) Institution of Naval Architects by Mr. A. C. Kirk:

It is well known that occasionally steel plates have been cracked in a way very mysterious and unaccountable, and the general cause to which it has been attributed was want of annealing, or that process done badly. But, whichever was the way, it has been commonly assumed that the cause is the existence of unequal strains in the plate produced by unequal cooling.

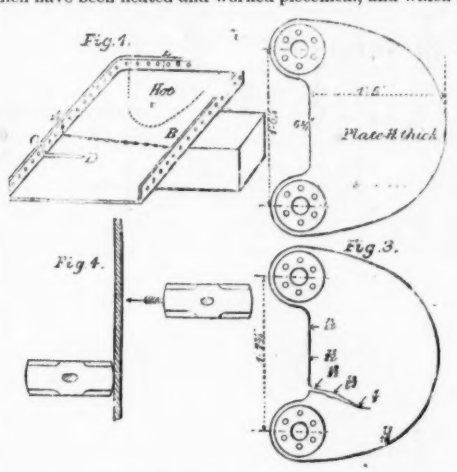
To confine this mystery to narrower limits, and elucidate the question of annealing, is the object of this short paper.

About the middle of June, last year, I had my first experience of these cracks, that it has ever been my good or bad luck to have happen actually in my own practice.

The plate (a back tube-plate) had been flanged at the smith's fire, heated all over in the furnace, straightened up, and allowed to cool in the usual way.

The centres of the tube holes were marked off for boring, and two men were deepening the centres for the boring machine with a flogging hammer and punch, when the plate cracked, as shown at *C D*, in the appended sketch, fig. 1, from which you will see that when it cracked the plate opened at *C*, showing that there was a strain at that point on the plate. The plate simply cracked, and was not in the least reduced in thickness on either side of the crack, showing that no extension previous to fracture took place, in this respect agreeing with all the best information I have been able to collect of similar fractures which have occurred elsewhere.

With regard to such cracks it has long been my opinion that it is hard to see how a material which can stretch 25 per cent. under a strain without fracture, can break with no extension at all. This is confirmed by many things we see often; notably so in steel rivets shrinking and never breaking, flanged boiler fronts, with holes flanged in them, which have been heated and worked piecemeal, and which I



have never found to crack, though tumbled freely about before they were put in the furnace and straightened; virtually annealed.

From this we may deduce, that when such fractures occur, there is a presumption that there has been from the beginning—from the ingot state, probably—a line of weakness, along which the fracture takes place. As this seemed worth testing, I set about it as follows:

I had the plate drilled across at the line *A B*, shown on Fig. 1. The remainder of the plate I had heated in the furnace all over to a bright red, removed, and laid outside, as in Fig. 1, and cold water and wet cloths applied to the shaded part marked "cold," till it was quite cold. At this time the unshaded part marked "hot" was hot enough to just set fire to straw. The whole plate was now cooled as quickly as possible.

Thus, I think, I succeeded in putting the upper part of the plate in tension to the utmost degree possible by unequal cooling, and if steel must break when that is done, it ought to have cracked in the flange marked "hot." Lying on a block of wood, I had it struck six times over various parts of its surface, by full blows of a 28-lbs. hammer, which produced no effect. I then had a 28-lbs. hammer held up against the flange at one side and struck four times with another, the only result being to bend the flange slightly. The same thing was repeated in the middle of the flange, at the "hot" end, with the same result.

I then had the flange at hot end at *E*, Fig. 1, nicked deeply on edge and both sides with a rod chisel and 28-lbs. hammer; after which the plate was struck six blows on the surface without fracture. After that the flange was held up on one side of the nick by the same hammer and struck four times on the other side, without starting a fracture. I then had it next supported on two blocks under the steam hammer about 6 in. apart, and bent the part between these 3 in., still without producing a fracture.

Thus, sound steel put intentionally into the greatest state of tension possible, by unequal cooling, does not crack, and cannot be cracked.

I have heard the proposition stated, I believe, in this room, by an eminent steelmaker, that contraction tears a plate, the fracture then commencing at the edge and gradually extending into the plate, and that thus, you could not expect to have extension as in a simultaneous fracture right across a piece of steel.

I now lay before you the result of having a piece of steel plate torn in this way, and the result will completely dispel any such illusion.

The plate I prepared was of mild steel, shaped as in ap-

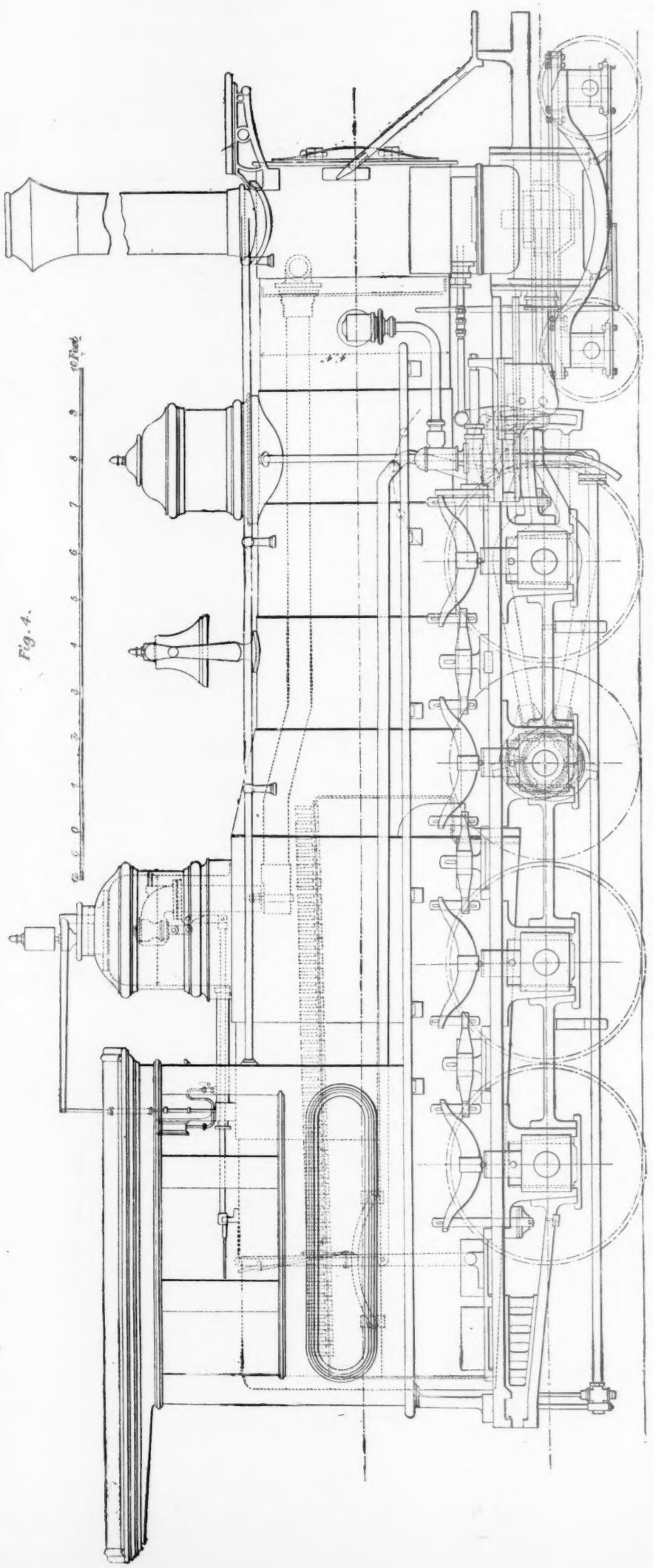


Fig. 4.

TWELVE-WHEELED FREIGHT LOCOMOTIVE FOR THE LEHIGH VALLEY RAILROAD.

pended sketch, Fig. 2, with the object of tearing it by direct tensile strain. The results obtained were quite in accordance with my expectations, the thicknesses decreasing in all directions towards the place of fracture, but more especially along the edge of the plate, and of the fracture, as will be seen on reference to appended sketch, Fig. 3.

The plate stretched between centres 1½ in. when rupture took place under a load of 80 tons. The action of stress throughout the material is distinctly marked in clearly defined lines, by the cracking of the surface skin or scale.

The experiment was carried out at Lloyd's testing house, and owing to the arrangements in their chain cable testing machine, one end only could be fixed to the machine head, while the other had to be fastened by a shackle to a cable end.

This, I take it, proves that the tearing theory—which, I confess, I never could comprehend—is no explanation; and further, that such cracks are simply due to lines of weakness in the steel, which annealing will not cure, although it may easily do harm: and that the best thing is a certain amount of rough treatment (even if done intentionally as a test), and if that cracks a plate, the plate is to be thankfully rejected.

I hold that I have succeded in proving, that these mysterious cracks in steel are not produced in the working of the steel after it is rolled, and where the germ exists, cannot be prevented from showing themselves by annealing; the only test being some rough usage and knocking about. It remains for the steelmaker to assign a cause for these fracture lines, and provide a remedy. After all, we have much fewer defects in steel than we had in iron, although, it is true, they are of a different kind.

Twelve-wheeled Freight Locomotive for the Lehigh Valley Railroad.

We give this week a full-page engraving and detailed views of one of a very powerful class of locomotives, constructed by the Lehigh Valley Railroad Company in its shops at Weatherly, Pa., from the designs of Mr. Philip Hofecker, the Master Mechanic of the Beaver Meadow Division. Three of these engines have been placed on the line, and are doing excellent service, two of them being built in accordance with our illustration, and the third having a somewhat larger boiler and steam-dome.

The following are the dimensions of the engine in detail:

Kind of fuel used	...Anthracite coal.

WEIGHT AND GENERAL DIMENSIONS.

Gauge of road	4 ft. 8½ in.
Total weight of locomotive in working order, including two men	101,696 lbs.
Total weight on driving wheels	82,432 "
Total wheel-base	23 ft. 2 in.
Distance between centre of front and back driving wheels	13 " 0⅜ "
Distance from centre of main driving wheels to centre of cylinders	11 " 8½ "
Length of main connecting-rod, from centre to centre of journals	7 " 9¼ "
Transverse distance from the centre of one cylinder to the centre of the other	6 " 10 "

Cylinders, Valves, Etc.

Diameter of cylinders and stroke of piston	20 in. × 26 in.
Horizontal thickness of piston over piston-head and follower plate	4⅝ "
Kind of piston packing	Cast iron.
Diameter of piston rod	3¼ in.
Size of steam ports	18 in. × 1¾ "
Size of exhaust ports	18 " × 2¾ "
Greatest travel of slide valves	4½ "
Outside lap of slide valves	11-16 "
Inside lap of slide valves	1-16 "
Lead of slide valves in full stroke	⅛ "
Throw of upper end of reverse lever from full gear forward to full gear backward, measured on the chord of the arc of its throw	4 ft. 8 in.
Sectional area of opening in each steam pipe connected with cylinders	18 sq. "

Wheels, Etc.

Diameter of driving wheels, outside of tires	48 in.
Diameter of truck wheels	24 "
Size of main driving-axle journal, diameter and length	6¾ in. × 7½ "
Size of other driving-axle journals	6¾ " × 7½ "
Size of truck-axle journals	4⅝ " × 7½ "
Size of main crank-pin journals	4⅝ " × 4⅜ "
Size of coupling rod journals	4 " × 4 "
Length of driving springs, measured from centre to centre of hangers	2 ft. 5 "

Boiler.

Description of boiler, straight or wagon top	4 in. wagon top.
Inside diameter of smallest boiler ring	51 in.
Material of barrel of boiler	Iron.
Thickness of plates in barrel of boiler	½ in.
Kind of horizontal seams	Lap seams, double riveted.
Kind of circumferential seams	Single riveted.
Material of tubes	Iron.
Number of tubes	199
Diameter of tubes, outside	2 in.
Distance between centres of tubes	2¾ "
Length of tubes, over tube plates	10 ft. 11½ in.
Size of fire-box, inside, length × width × depth from under side of crown plate to bottom of mud ring	138 in. × 34 in.
Depth, { front	4 ft. 4½ "
Depth, { back	3 " 7½ "
Water spaces, sides, back and front of fire-box	3 in., 3 in., 3 in.
Material of outside shell of fire-box	Iron.
Thickness of plates of outside shell of fire-box	½ in.
Material of inside of fire-box	Steel, crown sheet iron.
Thickness of plates in sides, back end and crown of fire-box	5-16 in., 5-16 in., ½ in.
Material of tube-plates	Iron.
Thickness of front and back tube-plates	½ in., ½ in.
Crown-plate stayed, with	Girder stays.
Diameter and height of dome	32½ in. × 30 in.
Maximum working steam pressure per square inch	125 lbs.
Kind of grate	Water grates.
Diameter of tubes of water grate	2½ in.
Width of opening between tubes	1 "
Grate surface	32 sq. ft.
Heating surface in fire-box	179 " "
Heating surface of the inside of tubes	995 " "
Total heating surface	1,174 " "
Kind of blast nozzle, single or double	Single.
Diameter of blast nozzle	5 in.
Smallest inside diameter of chimney	17 "
Height from top of rails to top of chimney	14 ft. 7 in.

Tender or Tank.

Weight of tender, empty	23,400 lbs.
Number of wheels under tender	Eight
Diameter of tender wheels	30 in.
Size of journals of tender axles, diameter and length	4 in × 9 in.
Total wheel-base of tender	14 ft. 6 "
Distance from centre to centre of truck wheels of tender	52 "
Water capacity of tank (in gallons of 231 cubic inches)	2,575 gals.
Coal capacity of tender or fuel-bin	8,960 lbs.

Engine and Tender.

Total wheel-base of engine and tender	46 ft. 9 in.
Total length of engine and tender over all	55 " 4 "

This plan of engine is becoming deservedly popular, as

similar engines have been built for other lines since the one illustrated was completed.

For the illustrations and data concerning these engines we are indebted to Mr. Robt. H. Sayre, Superintendent and Engineer, and to Mr. Philip Hofecker, Master Mechanic of this road.

The Pennsylvania Railroad's New Terminus in Philadelphia.

The following description of the new Broad street station of the Pennsylvania Railroad in Philadelphia, and of the approaches to it, are from the annual report of the General Manager of the road:

The Filbert street extension was opened for freight business on April 25, and for passenger business on Dec. 5. The line of this extension diverges to the left, from the passenger tracks in West Philadelphia, near Powelton avenue, by a 4° compounded at each end with a 30' curve; the tracks of the Pennsylvania Railroad, leading to the Junction Railroad tunnel, are crossed, overhead, by a five-span plate-girder bridge, and crossing the West Philadelphia yard on an embankment descending 0.5 ft. per 100 to Thirtieth street, which is crossed by a wrought-iron deck bridge, about 33 ft. above the grade of the street, thence over the low land north of the grain depot by a double-track steel-plate girder superstructure of 14 spans, ranging from 44 to 56 ft. in length, supported on wrought-iron columns, to the west side of the Schuylkill River. The freight track, leaving the West Philadelphia yard near the Scale House, crosses Thirtieth street and the ground north of the grain depot, by a single-track steel superstructure, similar to that described for the passenger tracks, but with an ascending grade of 1 ft. per 100, from Thirtieth street to the river. This track has also a connection with the Junction Railroad tunnel under Market street, to enable the trains from the Philadelphia, Wilmington & Baltimore Railroad to run into Broad street station.

The stone foundations for all the columns east of Thirtieth street are built on piles driven home and cut off at low-water mark. The Schuylkill River is crossed at a height of 40 ft. above city datum, and 42½ ft. above ordinary high tide, on a wrought-iron lattice truss of three spans, one of 144 ft., and two of 160 ft. each, making a total length of 464 ft., with three tracks carried on top chord, supported on two abutments and two piers of Eastern granite. The western abutment, 8 ft. by 38 ft. in size, and 22 ft. in height, is built on a timber foundation resting on piles driven to the rock under the western bulkhead of the river. The western pier is built on a crib constructed of square timber filled with stone and concrete, and resting on the rock bottom of the river, 31 ft. below low water. At the site of the eastern pier, the rock bottom was found to dip at such an angle that it became necessary to use a coffer dam for the purpose of making a proper foundation for the masonry, which was started from the rock. This pier is 49 ft. in height, and the bottom of the masonry is 67 ft. below the level of the track. The eastern abutment is located inside the wharf lines at foot of Filbert street, and is founded on the rock; this abutment is of same size as that on the west side of the river, but has an arched opening of 12 ft. span left in the centre, to give a passage-way from Filbert street to the river.

From the east end of the Schuylkill bridge to the east side of Twenty-first street the three tracks are carried over Filbert street on a steel-plate girder superstructure of 24 spans, varying in length from 49 ft. to 60 ft., resting on cross girders supported by iron posts from 22 ft. to 35 ft. in height, located on the curb lines; the stone foundations for these columns were founded on compact gravel from 12 ft. to 25 ft. below the surface of the street.

At Twenty-first street the line curves to the right with a 3° curve running across the property of the company, and reaches the west end of the Filbert street passenger yard at Shock street. From Twenty-first street to Shock street the three tracks are carried on three spans of steel superstructure of 44 ft. in length, two spans of 46 ft., and one span of 24 ft.

Early in the season of 1880, as soon as possession of the various properties was obtained by the company, between Twenty-first and Sixteenth streets, the removal of the buildings began and the ground cleared to enable the excavations to be made for the foundations for the arches. About 190 dwellings, stores, shops and stables, of all kinds, were taken down, the hard bricks cleaned and piled for use in the new work, and the débris carted away.

From Shock street to Sixteenth street, a distance of 2,042 ft., the road-bed, 106 ft. wide, for nine tracks, is carried over the streets on a series of segmental brick arches of the following dimensions, viz.: eight spans of 24 ft., 48 spans of 26 ft., and four arches over the cross streets of 50 ft. span. All these arches have a rise or versed sine of 7 ft.; street arches springing from abutment piers of 18 ft. in thickness at spring lines, and the smaller arches resting on piers of brick 4 ft. 4 in. in thickness, all built on stone foundation masonry from 6 ft. to 20 ft in depth. After the brickwork for the arches was all completed and thoroughly grouted, the whole upper surface or floor was covered with an asphalt pavement one and a quarter inches in thickness, laid on with hot irons, to prevent the water from percolating through the arches.

Along Filbert and Jones streets fronts there is a foot-walk 4 ft. in width, supported on brackets built in the brickwork and protected on the outer edge by an iron railing. This walk is for the use of employés who are engaged in the passenger yard.

Near Seventeenth street, on the northern side of the yard, there is located a wrought-iron turn-table, 60 ft. in length, to be used for turning the engines of accommodation trains. On the east side of Seventeenth street, and immediately east of the turn-table, a building has been erected with a hydraulic elevator for use in handling United States mail and materials for repairs of cars.

Sixteenth street is crossed by 12 tracks on bridges of the iron-plate girder pattern, filled in with brick arches to deaden the sound.

The building on the square of ground bounded by Fifteenth and Sixteenth and Market and Filbert streets, formerly used for freight station, has been entirely removed, and rebuilt of iron and brick, two stories in height. All the freight to be received from and delivered to wagons on the ground floor, where a platform 220 ft. by 390 ft. is constructed for that purpose; the freight being moved between the first and second floors with 16 hydraulic elevators, 8 ft. square, capable of lifting five tons each. All that portion of the second story, 134 ft. in width, from Market street, is laid with four tracks for freight, with standing room for 35 cars, with a platform 20 ft. in width between each pair of tracks. That portion of the second floor, parallel with Filbert street, extending from Fifteenth to Sixteenth streets and 170 ft. in width, is used for a shed for the incoming and outgoing passenger trains; each shed includes four tracks with two platforms 20 ft. in width, raised about 14 in. above the top of rail. This portion of the building is covered with a handsome curved roof, and the side next to Filbert street enclosed with an ornamental brick wall.

Fifteenth street is crossed by the eight passenger tracks on substantial iron plate girders, supported by brick abutments on each side. At this point the grade of the road is 19 ft. above the surface of the street. Between Fifteenth street and Merrick street, now called Broad, a distance of 122½ ft., and extending from Filbert street, southward, 190 feet, the passenger station is erected.

This building is built of brick, ornamented with terra cotta work, on a granite base, and is four stories in height. The first floor comprises a waiting room for passengers, ticket office, and baggage rooms, with a drive-way through to Fifteenth street. On the second floor are the main waiting rooms, which are lighted from the roof by a Hayes skylight; also restaurant and dining room, with a wide lobby extending the whole length of the building, leading to an exit stairway at the south end. The third story contains the kitchen and storerooms for use of restaurant, while the remainder of the room is reserved for offices of the company. The fourth floor, occupied entirely by offices, is arranged similar to that below. The building throughout is finished in the most substantial monner, and provided with all the required accommodation for passengers.

At the time the plans for this station, with the tracks and approaches, were completed it was not expected that the Philadelphia, Wilmington & Baltimore and the West Chester passenger traffic would be brought into it. After the purchase of the controlling interest in those lines their trains were all turned into the new station, and it is now found that their passenger business amounts to 43 per cent. of the entire traffic in and out of the station.

In order to insure as nearly as possible absolute safety in the movement of trains over the elevated road to and from the station, a complete set of interlocking switches and signals was designed, constructed, and placed in operation.

The towers, with interlocking arrangements which constitute the system, are arranged as follows: One at Thirtieth street, governing the switches and signals used for crossing out-bound Philadelphia, Wilmington & Baltimore Railroad trains over the main track and down to the Junction Railroad. This crossing is guarded by distant signals as far back as Powelton avenue, in order to prevent any possible chance of trains coming in off the main line colliding with the out-bound trains to the Philadelphia, Wilmington & Baltimore Railroad.

The tower at Twentieth street governs the switches and signals used in passing in-bound passenger trains from the Philadelphia, Wilmington & Baltimore Railroad to the main in-bound passenger track, and also for passing empty trains and locomotives for West Philadelphia out of the yard on to the main out-bound passenger track.

The tower at Seventeenth street, containing 56 levers, governs all switches leading to the passenger station, and sidings connected therewith. In connection with this tower is an overhead bridge, extending over the tracks entering the station, with six semaphore arms governing all in-bound trains and shifting engines.

The tower at the north end of the tunnel, on Junction Railroad, governs the use of switches and signals used to allow the trains of the Philadelphia, Wilmington & Baltimore Railroad to pass from the tracks of the Junction Railroad to the Filbert street extension.

A tower is under construction at Powelton avenue which will have an interlocking arrangement. There is at present a block signal tower at this point, the switches being worked by hand.

Fig. 2.

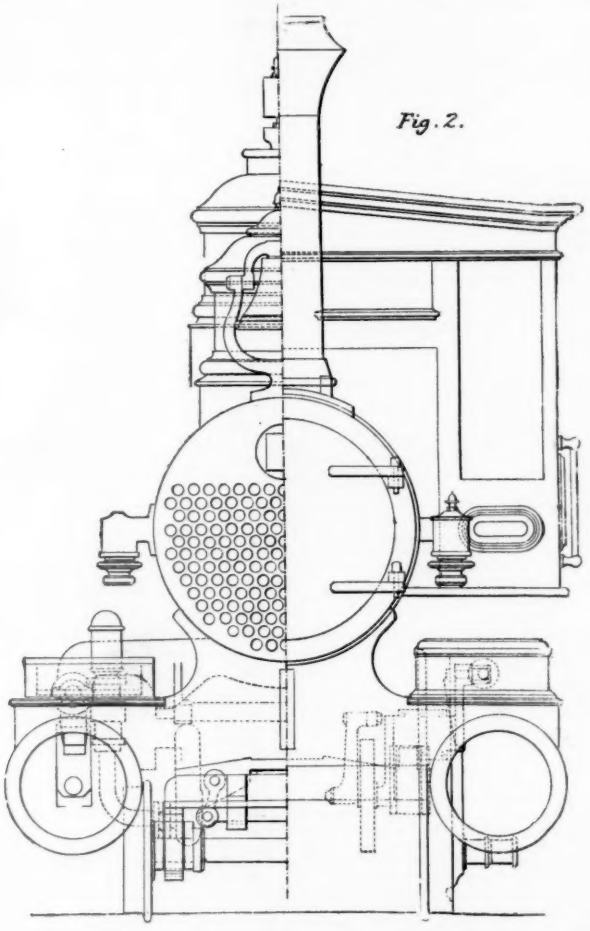
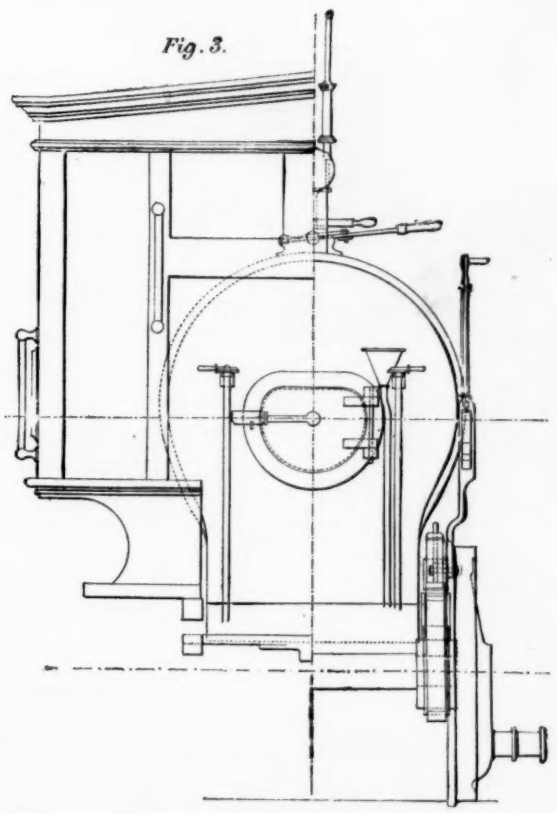


Fig. 3.



TWELVE-WHEELED FREIGHT LOCOMOTIVE FOR THE LEHIGH VALLEY RAILROAD.

Standard Screw Threads on Cars.

[*Report of the Committee of the Master Car-Builders' Association appointed "to investigate and report on the present construction of screws and nuts used in cars; and the amount of accuracy that is desirable to secure and the best means of maintaining it in the standard adopted by the Association in Richmond, Va., June* 15, 1871, *and to draw up communications addressed to the managers and superintendents of railroads, showing the necessity for the use of even sizes of screw threads, and the amount of saving, as near as it can be estimated, which will result to the roads by strictly adhering to this practice," made at the annual Convention in June*, 1882.]

The Committee to whom this subject has been referred, and who have had it under consideration for several years, find that to give a clear understanding of it a brief historical review of what has been done is requisite. Without other introduction, then, it may be said that in 1864 the inconvenience and confusion resulting from the diversity in the screw threads used in machine and other construction was

brought up for consideration before the Franklin Institute of Philadelphia. A committee was then appointed to investigate and report on the subject. That committee recommended the system designed by Mr. William Sellers, and the Institute afterwards adopted their recommendation. Practically the three systems from which they were obliged to choose were, first, the ordinary sharp V thread shown in figs. 1 and 2. Fig. 1 represents a section of an inch bolt full size, and fig. 2 a section of the thread enlarged eight times its actual size. Figs. 3 and 4 show Whitworth's thread and figs. 5 and 6 Sellers' system. The angle A and A' between the sides of the V thread is generally 60°, although this is not uniformly so, when it is the depth D, from the root of the threads to the point is slightly less than ¾ of the pitch. In the Whitworth thread the depth D is ⅝ of the pitch, and the top and bottom of the threads are then rounded as shown. The angles A and A' of the sides of the threads to each other are 55°.

The objections to the V thread are that the point or outer edge of the thread is sharp and therefore very frail and liable to injury from contact with other objects. The space S or groove between the threads, at the root, is also sharp, which facilitates fracture under strain and is a source of weakness in the screw. The depth D of the V thread, being slightly greater than that of the Whitworth thread, the effective diameter N of the screw, at the root of the thread, is materially less in the former than in the latter.

In figs. 4 and 6 the contour of a V thread is shown by the dotted lines *cb* and *db*. It will be seen that if a V thread is used instead of the Whitworth or Sellers the former would cut into the bolt farther, than the others do by a distance represented by *ab*.

The objections to the Whitworth thread are that the angle of 55° cannot be measured or laid off with ordinary tools, and that the rounded corners at the point and root of the threads are extremely difficult to produce with any degree of precision in the tools required to make screws. These considerations led Mr. Sellers to design the system of threads the form of which is shown by figs. 5 and 6. In this the angle of the V thread, 60°, is retained, but instead of rounding the point and root these are made flat, one eighth of the depth of the thread being taken off of the top, and one eighth at the bottom, which leaves the depth of the thread somewhat less than ⅝ of the pitch. This leaves the effective diameter N of the bolts somewhat greater even than that of the Whitworth thread. The flat top and bottom in screw-making tools can be easily and accurately made, and the angle of the thread can be produced by simply laying off a triangle having equal sides, or subdividing the circumference of a circle with its own radius, and drawing lines from adjacent points of subdivision to the centre. The difference in the effective diameter of the Whitworth and Sellers' systems of course gives them greater strength to resist tension and torsion than screws with V threads of 60° have. It is true that the V thread might be made with sides having a more obtuse angle to each other, but in that case the nuts would be subjected to greater strain.

In a report made in 1868 to the Chief of the Bureau of Steam Engineering of the United States Navy, by a board of engineers, the difference in the resistance to tension and torsion of bolts with Sellers' threads, compared with those having V threads, was calculated, and is given in the following table:

Table showing the increased percentage of tensional and torsional strengths of bolts having the Sellers' thread as compared with bolts having the common sharp V thread.

Diameter of screw.....	Number of threads per inch.....	Greater percentage of resistance to tension of bolts with Sellers' threads.....	Greater percentage of resistance to torsion of bolts with Sellers' threads.....	Diameter of bolt or screw.....	Number of threads per inch.....	Greater percentage of resistance to tension of bolts with Sellers' threads.....	Greater percentage of resistance to torsion of bolts with Sellers' threads.....
Inch.				Inch.			
¼	20	28.3	45.4	1	8	14.1	21.9
5-16	18	23.1	36.6	1⅛	7	14.6	22.7
⅜	16	21.5	33.9	1¼	7	12 7	19.7
7-16	14	20.9	32.9	1⅜	6	14.1	21.8
½	13	18.9	29.7	1½	6	12.4	19.2
9-16	12	17.8	28.0	1⅝	5½	12.4	19.2
⅝	11	17.6	27.5	1¾	5	12.8	19.8
¾	10	15.5	24.2	1⅞	5	11.7	18.1
⅞	9	14.6	22.3	2	4½	12.4	19.1

The data of this table may be approximately summed up by the statement that the smaller bolts, with the Sellers thread, have about a *quarter* more strength, the medium sized ones a *sixth* more, and the larger ones an *eighth* more strength to resist tension than screws having an ordinary V thread. The resistance to torsion of screws with the Sellers thread is about a *third*, a *quarter*, and a *fifth* greater than those with a V thread.

These advantages of the Sellers thread were recognized by the board of engineers referred to, and they reported that "the board unhesitatingly recommends it as a standard for the Navy." Mr. Isherwood, the Chief of the Bureau of Steam Engineering at that time, wrote to the Secretary of the Navy, and said that he "fully agreed with the conclusions of the report." Hon. Gideon Wells, at that time Secretary of the Navy, then issued the following order:

"The standard for the dimensions of bolts and nuts, as determined by the board, is, upon your [Isherwood's] recommendation, authorized for the naval service."

Soon after its organization the Master Mechanics' Association recommended the Sellers or Franklin Institute system of threads for general use in locomotion construction, and in 1871 the Car-Builders recommended it for cars.

Unfortunately, though, when this was done, a large proportion of the members of the two associations seemed to have the impression that the Sellers system consists simply in a standard for the number of threads to the inch, and apparently not sufficient effort has been made to impress the fact on the minds of those who have the control of such matters that three features are essential to the Sellers system:

FIRST, *screws must have a given number of threads per inch.*

SECOND, *the threads must be of the form and proportions designated.*

THIRD, *the diameters of the screws must conform to the sizes specified.*

A screw which does not conform to the Sellers system in all *three* particulars has not a legitimate Sellers thread. All screws with a number of threads per inch different from those given in the preceding table do not agree with the requirements of the Sellers system. But, even if the number of threads per inch is right, if the *shape* of the thread is different from that specified it is not a Sellers screw. It is just as much an illegitimate or bastard screw if the thread is made V shaped and the pitch right as though the pitch was wrong and the shape of thread was right.

The Committee wish to impress upon this Association that a specific diameter of the screw is an essential feature of the Sellers system. A screw with a Sellers thread must be of one of the diameters given in the table. There are no other sizes in the system, excepting some larger than those given, which are not used in car construction. There is no such thing, for example, as a Sellers screw 1⅛ in. in diameter. That size is not recognized and has no existence in the system, and if a screw is made, as is often done, ¾ in. in diameter "a sixty-fourth" or "a thirty-second," large it ceases to be a Sellers screw. Uniformity in diameter is as essential to interchangeability as uniformity in the number of threads per inch or the shape of the threads, and the importance of maintaining the former cannot be too strongly urged on this Association. Just as soon as the practice is introduced of making screw threads "over-size," or a thirty-second or sixty-fourth large, interchangeability of bolts and nuts becomes impossible. If the Sellers standard is adopted, no screws should be tolerated which are a fraction of an inch larger or smaller than the diameter specified for that system.

The Committee are quite well aware that the reason given for making screws over-size is that round iron is nearly always rolled larger than its nominal diameter, and that it is impracticable to cut it down to the required dimension with the dies used in cutting screws. *If* iron is over-size there will, of course, be this difficulty; but there is no serious trouble in getting round iron made of the right diameter. On the Erie road this whole subject was thoroughly investigated by Mr. Chanute a few years ago. He then found that manufacturers were furnishing nearly all iron for bolts over-size, and that the company was then consuming about 700,000 pounds of round iron for bolts. "On this," he writes, "we estimated the oversizes and weights to be not less than 5 per cent., making 35,000 lbs., worth at 3 cents per pound $1,050, which we paid for more than we ordered." He therefore issued the following order:

"*All iron and steel received for bolts shall be carefully inspected, to make sure that it does not run over or under size, and bars involving double cutting, or too small, shall be rejected.*"

This order has been in force for several years, and Mr. Chanute has informed your Committee that there is no practical difficulty in enforcing it. The manufacturers who supplied iron to the company were first notified that thereafter no iron which was over size would be accepted. The above order was then issued, and, although it was found necessary at first to reject a few lots received, the manufacturers soon "grasped" the idea, and since then there has been no trouble, excepting to inspect the iron and reject an occasional lot for not conforming to the proper dimensions. It will thus be seen that not only does the use of over size screws make interchangeability impossible, but it is also a source of additional expense to a railroad company which is not to be despised. There is therefore every reason for adopting the Sellers standard sizes of screw threads for all screws used in car construction.

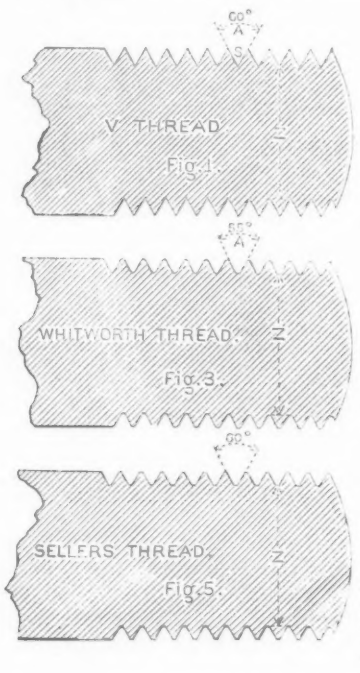
But, while the form, proportions and dimensions of the standard screw threads were as definitely fixed by Mr. Sellers and the action of the Franklin Institute as it is possible for them to be, and although it was thus made plain what the standard screws *should* be, subsequent experience showed that it was not so easy as it appeared to make them conform with a sufficient degree of precision for practical purposes to the requirements laid down by Mr. Sellers. This difficulty was very well described by Mr. Chanute at one of the monthly meetings of this Association in New York, held on Dec. 18, 1879.

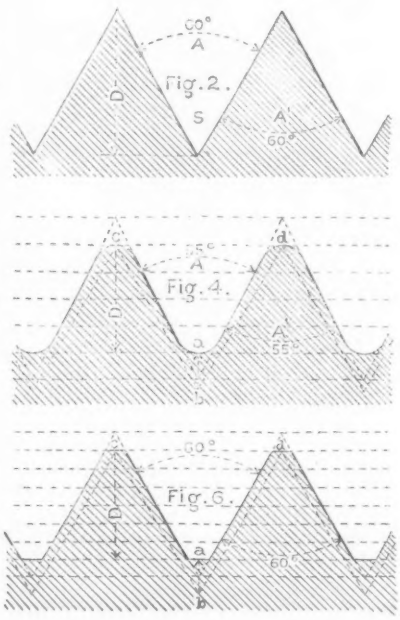
That gentleman was then in charge of the machinery department of the New York, Lake Erie & Western Railroad. The meeting was called to consider "The standard system of screw threads and the best method of maintaining exact sizes of screws so that bolts and nuts may be interchangeable." Mr. Wm. Sellers, the originator of the system which bears his name, and the manufacturers of taps and dies were invited to be at the meeting and were present. Mr. Chanute then said:

"In 1874 the Sellers system was adopted on the Erie road, and a set of standard taps and dies had been furnished to each of the shops on that line, which as they wore out were replaced by others made from the originals at each of the shops. In 1876 attention was called to the fact that some nuts cut at one shop would not fit bolts cut at others, and an investigation was made. A set of nuts of the different sizes were cut at each of the shops, and were sent to Messrs. Pratt & Whitney, who fitted soft plugs, made of Babbit metal, into each of these nuts. These were exhibited on the table. By taking at random a plug and a nut of nominally the same diameter it was found that the one would rarely fit the other. It was seen that not only were the diameters different, but in many cases the pitch and angle of the threads had been altered from the original standard and the taps made at different shops did not conform to each other. Nuts were taken from 23 or 24 foreign cars, and these not only were unlike their own screws, but were also unlike each other. This was the cause of great waste, detention and expense in making repairs.

"It was found, moreover, that the practice had generally obtained of making taps over size, so that all bolts above ⅝ in. in diameter were $\frac{1}{64}$ in. and the smaller bolts $\frac{1}{32}$ in. over size. Investigation showed that the company was paying for about 35,000 lbs. of iron more than would have been required if it had been furnished of exact sizes. Instructions were therefore issued that no more taps and dies should be made at the various shops, and since then these tools have all been bought from manufacturers of them at considerably less cost than they could be made for in the company's shops. It was supposed that in this way absolute uniformity could be obtained. In order to have the benefit of competition, however, taps were bought of different manufacturers. It was found, however, that some of the nuts cut with taps bought of one manufacturer could not be screwed on a tap made by another. This led to a request to the manufacturers to furnish sets of their standard screw gauges, which were compared with the standard gauges at the Brooklyn Navy Yard. To their surprise it was found that the gauges did not agree with each other, and although the difference was not very great it was sufficient to prevent the bolts and nuts, made to conform to them, from interchanging with each other."

After Mr. Chanute had made this statement, Mr. Sellers said: "The remarks lead me to believe that the difficulty does not exist in the system of screw-threads so much as it does in the matter of the original standard. * * * It perhaps has been thirty years since I first used what we supposed were standard sizes in our works, as I was very early impressed with the importance of having some standard to which we might refer all our measures. There was no one making standard gauges at that time, except Mr. Whitworth, of Manchester, England, and we imported a full set. They were very nicely fitted up—so nicely, indeed, that they seemed to be unsuited for the workshop, and I devised a set of inside and outside callipers for workshop use, and used the standard gauges merely for the purpose of reference. In our innocence, we never suspected that there might be, practically, different measurements of the same thing, or that there was any difference in such standard measures; and we might, perhaps, have gone on much longer in that blissful state of ignorance if it had not been





that we ordered another set from Mr. Whitworth, and when we had the two we found that they did not at all agree perfectly. It was impossible to determine which was right, without going into a very laborious investigation, which we could not think of, and we put the old set aside. I remember that we did not purchase the last set until after Mr. Whitworth had written his paper upon contact measurements, and we therefore used the last set, thinking that it would be more exact."

Subsequent inquiry elicited the fact that the manufacturers of taps and dies had been working to different standards. Soon after the Sellers standard was recommended by the Franklin Institute a number of sets of their new standard screw gauges were made by Mr. Fox. One of these sets is at the Brooklyn Navy Yard, and others were bought by manufacturers of taps and dies, and were used as standards to which they worked, while the Pratt & Whitney Company undertook to work to what they regarded as a true inch, and the fraction thereof. As neither the inch nor the gauges were certainly known to be correct, it is not remarkable that the bolts and nuts cut with tools made by different manufacturers were not interchangeable.

The question then came up, which was right? With commendable zeal the Pratt & Whitney Company undertook to test the matter by reference to the most reliable standards and measuring instruments in the country. Like Diogenes with his lamp, in search of an honest man, this company went to and fro in the land in search of a true inch, a true foot, or a true yard. They procured from different sources what they supposed were the most reliable standards of measurement, and found that none agreed. They had the same standards measured by what were considered the most reliable measuring machines and instruments in the country, and found that no two of these would measure the same standard alike.

It would lengthen out this report—already too long—to an unreasonable extent to detail their efforts in this direction. Let it be sufficient to say that the results of their investigations led them to doubt whether there was any final standard of reference in this country, or any instruments for measuring and subdividing the standard, if it existed, which could be relied upon to give results which would be at all satisfactory. Inasmuch as the matter was of very great importance to that company in the manufacture, not only of taps and dies, but of other tools, gauges and instruments of precision, they determined to go to the bottom of the subject and lay a foundation against which no wind or wave of doubt or uncertainty could prevail. Happily, about this time this company was brought into communication with

Prof. W. A. Rogers, connected with the Cambridge Observatory, and Professor of Astronomy at Harvard College, who was interested, for a widely different purpose though, in the subject of precise measurements, and had studied it here and in Europe. He was satisfied that the celebrated Whitworth measuring machine had very great defects, and therefore he proposed an entirely different system. He had the ideas, and the Pratt & Whitney Company had the means and the skill to put them into practice. The astronomer and the mechanics therefore co-operated, and the former supplied the plan for a comparator, or measuring machine, and it was agreed between them that the company should make two of them, one to be used by Professor Rogers in his scientific investigations at Cambridge, and the other the Pratt & Whitney Company would use in connection with the manufacture of tools for minute measurement, gauges, etc.

The company also procured the services of Mr. George M. Bond, a graduate of the Stevens Institute, who has had charge of the work done on the machine, and to whom much of the credit is due for the results attained. Ever since your Committee was first appointed, the Pratt & Whitney Company has been engaged in constructing these machines and doing the preliminary work and producing the plant with it which was required to construct exact screw and other gauges.

It will be impossible in a report like this to give a description of the methods employed to secure the utmost attainable precision, nor of the construction of this machine. It must be sufficient to say that with it measurements of $\frac{1}{50000}$ of an inch can be made with certainty. To give an idea of what is implied by this, let it be supposed that a person should take a pair of dividers and lay off 50,000 prick marks ⅛ of an inch apart in a straight line. To do this the line would require to be over 520 ft. or a tenth of a mile long. Imagine that many prick marks compressed into the space of 1 inch, and you have an imperfect idea of the minuteness of the measurements which can now be made by the Pratt & Whitney Company.

Doubtless there are many members of this Association, who, like the members of this Committee, when they undertook the work assigned to them, if asked what are the actual standards of measurement in this country could not answer such an inquiry. A brief statement of what the existing standards of linear measurements actually are may therefore be interesting. Like many other good things, we have inherited these from Great Britain. In 1834 the British standards were destroyed by the burning of the Parliament buildings. In an article in the *Franklin Institute Journal* of February, 1880, by Professor Hilgard, he says:

"The actual standard of length used in this country was a bronze scale of 82 in., subdivided on silver to tenths of inches, which had been prepared for the Coast Survey of the United States by Troughton, of London. The 36 in. comprised between the 27th and 63d inches, found equal to the average of the whole scale, were taken as the standard yard, and the tepermat re at which this was considered to be standard, that is to say equal to the British standard yard, was presumed to be 62° Fahr.

The Troughton scale was made before the destruction of the British standards. Since then the latter have been reproduced by reference to all the accredited standards with which they had originally been compared. In Clark's "Manual for Mechanical Engineers" it is said: "The present British standard yard is a solid square bar of gun-metal, kept in the office of the Exchequer at Westminster, 38 in. in length, 1 in. square, at the temperature 62° Fahr., composed of copper 16 ounces, tin 2¼ ounces and zinc 1 ounce. Two cylindrical holes are drilled half through the bar, one near each end, and the centres of these holes are 36 in. or 3 ft. apart—the length of the imperial standard yard."

Since the British standards have been reproduced some fifty copies have been constructed and intercompared, and certain of these copies have been sent to the United States. According to Professor Hilgard, recent comparisons have shown that the Troughton scale is 0.00076 in. in the yard too long. He says: "This change, though sensible in operations of extreme scientific precision, is really of no consequence in ordinary practice.

"Extreme accuracy in this matter is beset with great difficulties, for in addition that of ascertaining for each particular bar the rate of dilatation by temperature, there is an uncertainty in regard to permanence in the length of the bars themselves. Of the two standard yards presented to the United States, one is of bronze and the other of Low Moor wrought-iron. These are found to have changed their relative length by 0.00025 in., or 1-4000 of an in. in 25 years, the bronze bar being now relatively shorter by that amount."

The standard bars used by the Pratt & Whitney Company, were first prepared by them, and were graduated by Professor Rogers, and were then sent to Washington to be compared with the standards there. Professor Hilgard reported that one bar was 0.000053 inch longer than the imperial yard, and another was 0.000036 inches shorter than this unit; the mean of the two bars differs from the imperial yard by a quantity less than the *certainty* with which such comparisons can be made, viz.: 0.00001 inches.

After having a bar of standard length, it becomes necessary to subdivide it into such divisions as are required in practical use. A hardened steel six-inch bar was thus graduated into line measure, and is the one which is chiefly used as the standard for the measurements required in the manufacture of screw gauges. To quote from a paper read before the American Society of Mechanical Engineers by Mr. Bond, this bar has ruled "upon its upper polished surface lines, ruled four separate inches, also lines representing—counting from the end of the second inch—the lengths corresponding to the *bottom* diameters or 'tap-sizes' of the United States or Franklin Institute standard screw threads, from a quarter inch to four inches."

The lines of graduations on this bar are so minute that it requires good eye-sight to see them with the naked eye. All comparisons of these divisions are made by observing the lines through a microscope. The bar was ruled or graduated upon a dividing engine made by the American Watch Company at Waltham.

To give an idea of the difficulty of making exact measurements, it may be said that every good workman knows that much greater exactness of measurement is possible with two rules used "end to end" than can be made by drawing a line at the end of one rule and then measuring to that line with the same rule. In the same way a pair of callipers can be set more exactly to a gauge than to the lines or divisions on a rule. The one method is called "end measurement" and the other "line measurement." For practical use the line graduations on the six-inch bar referred to must be reduced to end measurement, or, in other words, it must be possible to make a gauge which, measured over all, will coincide *exactly* to the graduations on the bar. It will be impossible to explain the ingenious way in which this is done with practically absolute precision, and also the way in which end measurement of a gauge, or of one bar, can be compared with the graduations on another bar on the machine described. This can be done quickly and with the utmost precision. Gauges of any dimension indicated on the bar can be made and verified, and from these end measurements can be taken to work with.

But it may be asked in what way are car-builders concerned, or of what practical value are such extremely minute and exact measurements to them? In reply it may be said that much smaller measurements than persons usually suppose are of importance in ordinary work, and as a matter of fact workmen are constantly in the habit of measuring with callipers, and other means quantities as small as 0.001 of an inch or even much less than this. This was illustrated by a plug and ring which was exhibited. The former was ½ in. in diameter, and fitted the ring as nearly perfectly as it is possible to make it fit. The second plug is 0.001 of an inch smaller than the first one. The second one fits so loosely in the ring that you can feel it shake. A good machinist in fitting the pins in a link motion can easily discern a difference of much less than 0.001 in. in the diameter of the pins or their bearings. If the latter are of the right size and some of the pins are that much too large, interchangeability will be impossible. The same thing is true of screws and nuts. To illustrate this, a ¾ bolt and nut were shown, the two being an example of an ordinary good fit. Another bolt $\frac{1}{5000}$ smaller in diameter was also exhibited. The nut was so loose on the latter that any good mechanic would pronounce it a bad fit and a bad job. It will thus be seen that in practice a very considerable amount of precision is required in order to secure good workmanship. As a matter of fact, there are no serious difficulties in maintaining such a degree of precision in practice if there only is some standard to work to.

The results of the investigations of Mr. Chanute on the Erie road showed what occurs when taps and dies are made nominally of the Sellers system, but with no common standard of measurement. To maintain a system of screw threads which will be interchangeable, it is essential that they be made to some common and exact standard of measurement. The uncertainties of two foot rules are too great to maintain an interchangeable standard when as much precision is required as is needed in screws. If the shops and manufacturers have standards of measurement which do not agree, the screws made from them will of course not be alike. It is essential therefore that there should be a uniformity in the standards. This it is extremely difficult to bring about, and unless the standard proposed is as near right as it can be made, it will be impossible to secure its general adoption. People object to conforming to what they know is not right, and the person who can say my standard is right and yours is wrong has an unanswerable argument in favor of his practice.

Besides being important that standards should be exactly right, it is essential that it should be possible to reproduce them to any extent that is desirable, even though the original was lost. This the Pratt & Whitney Company has supplied the means of doing.

It may be said, also, that even if a degree of precision at all approximating to that which has been arrived at by the Pratt & Whitney Company could be attained in the manufacture of screws and nuts, it could not be kept up on account of the wear to which taps are necessarily subjected.

Messrs. Hoopes & Townsend, of this city, have informed your committee that the record taken from their books shows that with a ¾ in. tap they have tapped 18,800 cold-pressed nuts without any difference being perceptible in the size of the nuts. With a ⅝ tap they have cut 16,260, and with a ½ in. tap 18,000 without perceptibly changing the size of the nuts.

It may be thought, though, that accuracy and interchangeability of the Sellers system of screws can be maintained if they are only made of the right pitch and of the specified diameter on the outside and at the root of the thread, and if the tool for cutting the latter is made of the proper form and the thread is then cut so that the flat at the point and root are equal. This is true if all these operations are performed with the requisite degree of precision. It would be interesting to describe all the processes, the tools and instruments which are used by the Pratt & Whitney Company in making taps, dies and screw gauges, but to do so would increase this already extended report to inadmissable dimensions. A brief general description is all that can be given.

The first step in making a tap or screw gauge is to turn a bar of steel to the exact diameter of the outside of the screw. Then, each end of the portion on which the thread is to be cut is turned down to the diameter of the screw at the root of the thread.

On the exactness of this first operation the precision of the ultimate size of the gauge or tap will depend. It is therefore essential to be able to measure exactly these two diameters. The next step is to cut the thread. To do this a tool must be ground which will cut a thread whose sides will have an angle of exactly 60° to each other. An amount equal to one-eighth of the pitch must be taken off the point of the tool, the flat portion being true to the sides of the thread. To make a true thread the tool must then be set so that its centre line will be square with the axis of the screw. In order to be able to do this the sides of the tool are ground so as to be true parallel planes, and the parts which cut the sides of the thread are ground so as to be true with the sides of the tool and at an angle of 60° to each other. It can then be set true in a lathe with a square bearing against its sides, and against the blank tap or headstock of the lathe. What adds to the difficulty, though, is the fact that a cutting tool of this kind does not stand vertically, but at an angle of 20° to a perpendicular line. The top surface is horizontal. Now if the portions of the tool which conform to the sides of the thread were ground with an angle of 60° to each other, the edges of a plane which intersects these sides at an angle of more or less than 90° would not be inclined at an angle of 60° to each other. For this reason the tool must be ground at an angle of somewhat less than 60°, so that the cutting edges formed by the intersection of the flat top surface and the inclined edges of the tool will be exactly 60°.

It would be impossible, without elaborate illustrations, to give a description of the delicate instrument which is used to measure the exact amount which should be taken off the point of the tool for cutting threads of various sizes. It must be sufficient to say that this too is done with the highest degree of precision.

These processes and appliances are required to make a turning tool of the exact shape and size to cut the threads of screw gauges. With such a tool, then, and a blank for a gauge, such as has been described, it would seem that by cutting the thread so that the point of the tool would just touch that part of the blank which has been turned down to the size of the screw at the root of the thread, the screw must be of exactly the right size. If, as has been said, all the work described has been done with absolute precision, such will be the case; but in order to verify it, the same tool used for cutting the thread is put into a planer or shaping machine, and a template is cut with it out of a thin piece of steel. The space cut out of the steel plate will, of course, be an exact duplicate of the space between the threads. As the spaces at the root of the threads should be exact counterparts of the point of the threads themselves, the latter can be measured by the template, and if they are exactly alike it will indicate that all the operations have been performed with the required precision. If so, the screw thus made supplies a true gauge to work to. It should be kept in mind that the sides of the threads of a screw are, or should be, the actual bearing surfaces, and that in making taps and dies, the threads should be measured over the sides. With such a gauge as will be supplied by the screw described, it is an easy matter to set an ordinary pair of callipers over the sides of the threads, and then reproduce that size in any number of other screws or taps. A skillful tool maker will measure with ordinary callipers to within $\frac{1}{20000}$ of an inch, provided he has a correct gauge to set his callipers by. Experience has shown that with a gauge of the kind described to work from, a very high degree of precision can be attained, but it was also found that it was always necessary to make an allowance for the wear of the cutting tool which occurred when it was first used, and therefore to make it somewhat larger than the actual size of the thread.

But there is still another difficulty with screw gauges. If they are made as described, the steel must of course be soft and a very little use would soon destroy their accuracy. It is therefore requisite that working gauges should be hardened. The process of doing so, however, changes their form and dimensions slightly, so as to destroy their accuracy. To get over this difficulty hardened gauges are made somewhat larger than the standard size. The Pratt & Whitney Company have devised a plan to grind these gauges, after they are hardened, to the exact size, form and pitch. To do this the gauges are put into a lathe and a rapidly revolving steel disk or wheel is attached to the tool-holder which is moved by the lead-screw, whose pitch is exactly that of the screw of the gauge. Diamond dust is used on this disk for grinding the hardened threads, and the exact size is reproduced from a soft gauge, whose dimensions have not been changed by hardening.

For the most exact standards of reference, the Pratt & Whitney Company recommend the unhardened gauges. For standards of reference which must be used oftener, and where a high degree of precision is also required, they recommend the hardened and ground gauges.

They will also furnish another kind which are hardened but not ground to be used in the shop as reference gauges and which are correct enough for practical purposes. Specimens of all these kinds were submitted with the report.

It should be clearly understood that none of these gauges are intended for shop use, and that if subjected to much wear their accuracy will soon be destroyed. The size of new taps may be tested by them, and if of the correct size a few nuts may be cut with the new taps, and these be used as shop gauges by the workmen. As these wear they can be replaced with new nuts cut with other new taps.

The external gauges, it will be seen, are made adjustable. The internal gauge is the real guide to work from and the former can always be set from the latter. The committee find that there is some difference of opinion among those having most knowledge of the subject with reference to the need of the external gauges. Some hold that a correct internal screw gauge is sufficient to test the size of a tap from, and that then the nuts, already referred to, will answer for working gauges to maintain sizes in the shop.

Complete sets of gauges like the samples exhibited can be furnished by the Pratt & Whitney Company in a few weeks or months, and the Committee think that the master car-builders, and all who have occasion to use screws, may be congratulated that standard screw gauges can now be procured made with a degree of precision which has never been attained heretofore, and that this has largely been due to the agitation of the subject by this Association. It is worthy of note that a remedy for the evil complained of by master car-builders, that nuts made by some firms or at some shops would not screw on bolts made at others, at first baffled the ability of the most prominent manufacturing companies of tools of precision in the country, and that to provide an adequate remedy it was necessary to secure the assistance of the highest scientific ability in the country, which was supplied through the co-operation of the Professor of Astronomy of the oldest and most noted institution of learning in the land. The man of science turned his attention from the planets and the measurement of distances counted by millions of miles, to listen to the imprecation, perhaps, of the humble car-repairer lying on his back and swearing because a ¾ nut—"a leetle small"—will not screw on a bolt a "trifle large." It is a striking example of the assistance which science can give in conducting the "practical" affairs of life.

In conclusion the Committee would recommend that this Association, in conjunction with the Master Mechanics' Association, procure a set of the unhardened gauges manufactured by the Pratt & Whitney Company, and that these be kept among the archives of one or the other of the associations as the standard of measurement of screw threads and for ultimate reference in case of need.

They would also suggest the adoption of the following motion:

That this Association deprecates the use of screws larger or smaller in diameter by a small fraction of an inch than the sizes specified for the Sellers or Franklin Institute system, and that all its members are urged to abandon entirely the use of over or under-size screws.

That the thanks of this Association be voted to the Pratt & Whitney Company for the intelligence, liberality and enterprise shown in their efforts to establish a system of accurate gauges for screws and for tools for precise measurement.

That the Committee which prepared this report be instructed to send a copy of it with a suitable circular, calling attention to the importance of adopting *the* correct standard Sellers system of screw threads, to the presidents, managers, superintendents and master car-builders of the United States, Canada and Mexico, and that when the Committee has performed that duty it be discharged.

M. N. FORNEY.

Contributions.

Papers on Painting.—No. 11.

BY CHARLES L. CONDIT.

As it is necessary to use very frequently some of the terms defined in the first installment of these articles, but which readers may not remember, we repeat below a part of the "Little Dictionary" then published.

Oil Acid.—An acid which when linked with glycerine ether is known as an oil.

Oil.—An oil acid linked with glycerine ether, and from which glycerine and soap can be made.

Soap.—An oil acid linked with soda, potash, lead, zinc, iron or some such substance. Some soaps do not dissolve in water.

Free Oil Acid.—An oil acid unlinked from glycerine ether, but not united with another substance.

Oxy-Linseed Oil Acid.—An oil acid unlinked from its glycerine ether and containing more oxygen than the linked acid, but less than the dried oil. It may be white or red.

Flying Oil Acid.—An oil acid which becomes lighter than

air (due to action of heat or light) and flies away as would a gas.

THE COLOR OF LINSEED OIL.

The color of oil (and of varnish as it is affected by oil) is a less important matter than it is commonly thought to be. Bleached oil darkens with age, and unbleached oil becomes colorless under sunlight.

There are, however, many varieties of change in the color of painted and varnished surfaces, and we must distinguish these from each other, at least in a general way, before making an intelligent study of this subject.

Of course, the causes of some of these changes are a matter of opinion, but there is scientific opinion for some of those which will be most quickly disputed.

Changes in Color of Paint.

Change due to	*Cause.*	*Tendency.*	*Result.*
Oil	No sunlight.	Reddish.	Yellow.
Resins, etc.	In wood.	Yellowish.	"
*Ammonia gas.	From manure.	"	Brown yellow.
Lead pigments.	Sulphur gas.	Black.	Black gray.
Lead driers.	" "	"	Gray.
Manganese driers	Oxygen.	Brown.	Brownish yel'w
Verdigris	"	Dark.	Blackening.
Mixtures of pigments			Muddy colors.
Sinking in of oil.	Heat, etc.		Loss of brilliancy.
Fading of colors.	Light and air.		Less distinctive — whiter or darker.

Changes in Color of Varnish.

Change due to	*Cause.*	*Result.*
Oil	To much heat in boiling.	Dark.
Gums	Too dark.	"
†Copper varnish kettles	Not clean.	Green.
‡Dampness	Change in gums.	Dull.
"	" "	White.
Lead driers	Sulphur gas,	Dark.
Manganese	Oxygen.	Brownish yellow.
Ammonia gas		" yellow.
Oil	Want of light; heat.	Yellow.
Coal gas		Blue.
§Sinking in of oil	Want of proper foundation.	Loss of brilliancy.

If space allows, changes in pigments will be treated of in another place.

The Fresh Oil.—Linseed oil should always be bright, of a more or less yellowish green color. It is not so bright nor so light of color when fresh, because apparently of some of the coloring matter of the seed plant which has been pressed out with it. How much of the plant substance, the plant flesh, is in the seed is a very open question, which no chemist would wish to decide hastily. Mulder asserts, however, that there is very little, and that of no consequence, except as to color. Oil to be boiled, especially, needs to be freed from this turbid muddiness, or it will, under heat, become very dark. As stated in the last article, there is reason to believe that imperfect oil mixed with the coloring matter of the seed is the cause of this change of color.

To get rid of the coloring matter of the seed in the oil (or the colored oily matter) and of all plant flesh, time only is necessary. Oils are much too soon used; in as many weeks as months should be allowed, *i. e.*, in three weeks instead of three to six months.

The process is, however, hastened by sunlight, and if the oil be put into leaden vessels exposed to the sun, and a clear and more quickly drying oil is produced. The same effect is produced much more rapidly in glass bottles, likewise exposed, and not tightly corked. The effect is hastened if certain substances (see close of article) and among them old turpentine, be added to the oil. Turpentine takes up oxygen from the air and produces peroxide of hydrogen, which aids in bleaching the oil.‖

Another method is simply to heat the oil to 176°. If air be blown through it at the same time, its drying properties will be improved, and a clearer oil produced. A more troublesome method is the filtering the oil through animal charcoal.¶ This process makes the oil water-clear, but still gives no advantage in drying, as will be seen by the following table. I have not been able to find any facts proving that a dark oil dried more slowly.

Water-clear Oil filtered through Animal Charcoal.

		Grammes oil.
April 4		1.992
" 5	gain	0.003
" 7	"	0.004
" 11	"	0.044
" 16	"	0.150
" 22	"	0.110
" 26	"	0.004
May 4	loss	0.002
" 14	gain	0.002
" 28	"	0.004
June 18	"	0.002
July 26	lost	**0.902

* Ammonia and sulphur gases are always found together. The direct effect of ammonia upon oil is yellow; of the sulphur gas on the lead pigment or drier, blackening.

† The difficulty is with the gum kettle or the still. The cure is silver plating, or (a cheaper one) a coat of true amber varnish.

‡ The gums are separated to some extent from the oil; it is a mechanical and not a chemical change.

§ Kauri gum quickly loses its lustre without other changes, but the best quality holds its lustre fairly well.

‖ This method is recommended by several good authorities, but it must be looked upon with suspicion of injuring the drying qualities of the oil. The following are the results of a chemist who experimented on the action of peroxide of hydrogen on drying and other oils: "When a few drops of a weak solution of HO_2 (if containing only half a volume) are mixed and shaken with a drying oil—such, for instance, as linseed, nut, cotton-seed, poppy, etc.—linolic or palmatine acid are immediately separated from it, which, if put into a basin to settle, the linolic acid subsides to the bottom in the form of a greasy mass, while the palmatine acid sets in fine sheets upon the top of the oil. The remaining fluid oil *loses its property of a drying oil*, and becomes a non-drying oil." This fact (if it be a fact) may explain the great differences in opinion among chemists as to the drying effect of turpentine.

¶ In filtering fine oils and varnishes, the commercial animal charcoal should be purified by washing with muriatic acid. Into a four-gallon stone pot, put one-third of a bushel of animal charcoal, and add 13 lbs. of crude muriatic acid, allowing the mixture to stand one day. Then in a tub containing 22 gallons of water wash the charcoal entirely free from acid. Place the charcoal in a filter, reducing the particles to the size of coarse sand.

** Becoming yellow.

RAILROAD EARNINGS IN MAY.

NAME OF ROAD.	MILEAGE. 1882.	1881.	Inc.	Dec	P.c.	EARNINGS. 1882.	1881.	Increase.	Decrease.	P. c.	EARNINGS PER MILE. 1882.	1881.	Inc.	Dec.	P. c.
Ala. Gt. Southern	290	290	.....	.....	.....	$ 54,853	$ 52,304	$ 2,549	$	4.9	$ 189	$ 180	$ 9	$	4.9
Atchison, Top. & S. F.	1,810	1,670	140	....	8.5	1,153,611	1,046,125	107,486	.....	10.3	637	626	11	.....	1.7
Buffalo, Pitts. & West	205	205	.....	.....	.....	66,876	50,813	16,064	.....	31.6	326	248	78	.....	31.6
Bur., Ced. Rap. & No.	620	564	56	....	9.9	199,278	165,630	33,648	.....	20.3	321	294	27	.....	9.2
Cairo & St. Louis	146	146	.....	.....	.....	28,643	32,269	.....	3,626	11.6	196	221	.....	25	11.6
Central Iowa	244	190	54	....	28.4	84,417	74,067	10,350	.....	14.0	346	390	.....	44	11.3
Central Pacific	2,995	2,635	360	....	13.8	2,353,000	2,091,411	261,589	.....	12.5	786	794	.....	8	1.0
Ches. & Ohio	517	435	82	....	18.9	255,939	252,235	3,704	.....	1.4	495	580	.....	85	14.7
Chicago & Alton	847	840	7	....	0.8	553,412	548,556	4,856	.....	0.9	653	653	.....	.....	.....
Chi. & Eastern Ill.	232	220	12	....	5.5	143,113	117,296	25,817	.....	22.1	617	533	84	.....	15.9
Chi. & Gd. Trk	345	335	.....	.....	.....	186,254	133,624	52,630	.....	39.3	556	399	157	.....	39.3
Chi., Mil. & St. Paul.	4,260	3,800	460	....	12.1	1,620,000	1,538,941	90,509	.....	5.9	382	405	.....	23	5.7
Chi. & Northwestern.	3,280	2,800	480	....	17.1	2,058,133	1,879,006	179,127	.....	9.6	627	671	.....	44	6.6
Chi., St. P., M. & O.	1,050	950	100	....	10.5	406,420	350,125	56,295	.....	16.1	387	369	18	.....	4.9
Chi. & West Mich.	336	320	16	....	5.0	128,086	108,347	19,739	.....	18.3	381	339	42	.....	12.4
Cin., Ind., St. L. & Chi.	300	300	.....	.....	.....	109,110	101,096	8,014	.....	4.2	664	637	27	.....	4.2
Cin., N. O. & T. Pac.	336	336	.....	.....	.....	208,188	177,125	31,063	.....	17.8	620	527	93	.....	17.6
Cleve., Akron & Col.	144	144	.....	.....	.....	43,255	34,992	8,263	.....	23.6	300	243	57	.....	23.6
Col., Hock'g V. & Tol.	320	320	.....	.....	.....	239,817	114,529	125,288	.....	109.4	749	355	394	.....	109.4
Denver & R. G.	1,062	690	372	....	53.9	614,298	514,767	99,531	.....	19.3	578	746	.....	168	22.5
Det., Lan. & No.	226	226	.....	.....	.....	134,576	116,004	18,572	.....	16.0	595	513	82	.....	16.0
Eastern	284	282	2	....	0.7	273,361	251,465	21,896	.....	8.7	963	892	71	.....	8.0
E. Tenn., Va. & Ga.	900	900	.....	.....	.....	231,146	208,075	23,071	.....	11.1	257	231	24	.....	11 1
Evansv. & T. H.	157	144	13	....	9.0	63,371	55,748	7,623	.....	13.6	404	389	15	.....	3.9
Flint & Fere Mar.	345	318	27	....	8.5	176,137	160,706	15,431	.....	9.6	511	505	6	.....	1.2
Gr. Bay, Win. & St. P.	220	220	.....	.....	.....	30,289	37,117	.....	6,828	15.8	128	169	.....	31	15.8
Hannibal & St. Jo.	292	292	.....	.....	.....	154,917	172,950	.....	18,033	10.3	531	592	.....	61	10.3
Houston, E. & W. Tex	104	88	16	....	18.2	23,057	11,708	11,349	.....	97.0	222	133	89	.....	66.9
Ill. Cen., Ill. lines	918	918	.....	.....	.....	534,983	527,266	7,717	.....	1.4	583	576	7	.....	1.4
Iowa lines	402	402	.....	.....	.....	139,766	145,993	.....	6,227	4.3	348	363	.....	15	4.3
Ind., Bloom. & West.	555	555	.....	.....	.....	182,554	200,064	.....	17,510	8.8	329	360	.....	31	8.8
K. C., Ft. S. & G.	360	305	55	....	18.0	116,017	115,809	208	.....	0.2	322	380	.....	58	15.3
Lake Erie & Western	388	388	.....	.....	.....	94,484	102,605	.....	8,121	7.8	245	265	.....	21	7.8
Little Rock & Ft. S.	168	168	.....	.....	.....	30,200	32,700	.....	2,500	7.7	180	195	.....	15	7.7
Long Island	335	320	15	....	4.7	179,482	157,003	22,479	.....	14.3	536	491	45	.....	9.2
Louisville & Nash.	2,025	1,840	185	....	10.1	946,435	828,725	117,710	.....	14.2	467	450	17	.....	3.8
Mar., Hought. & Ont.	88	88	.....	.....	.....	179,000	71,000	108,000	.....	152.1	2,034	807	1,227	.....	152.1
Mil., L. S. & West.	280	250	30	....	12.0	63,938	44,556	19,382	.....	43.1	228	178	50	.....	27.8
Mo. Pacific lines:															
Central Branch	387	300	87	....	29.0	57,902	82,605	.....	24,703	29.8	150	275	.....	125	45.5
Int. & Gt. Northern	775	623	152	....	24.4	235,830	170,319	65,511	.....	38.5	304	273	31	.....	11.5
Mo., Kan. & Tex.	1,230	900	330	....	36.7	480,334	393,745	86,589	.....	22.0	391	437	.....	46	10.5
Mo. Pacific	935	800	135	....	16.9	560,907	589,476	.....	28,569	4.9	600	737	.....	137	18.7
St. L. I. M. & So.	750	685	65	....	9.5	519,120	479,075	40,045	.....	8.4	692	699	.....	7	1.0
Texas & Pacific	967	749	218	....	29.1	409,228	281,783	127,445	.....	45.3	423	376	47	.....	12.5
Mobile & Ohio	528	506	22	....	4.3	137,645	145,803	.....	8,158	5.6	261	288	.....	27	9.4
Nash., Chatta. & St. L.	467	467	.....	.....	.....	135,556	164,430	.....	28,874	17.5	290	352	.....	62	17.5
N. Y. & N. England.	396	316	80	....	25.3	280,744	217,186	63,558	.....	29.0	709	687	22	.....	3.2
Norfolk & Western.	428	428	.....	.....	.....	185,322	149,603	35,719	.....	23.8	433	349	84	.....	23.8
Northern Central.	326	326	.....	.....	.....	482,667	465,588	17,079	.....	3.6	1,481	1,428	53	.....	3.6
Northern Pacific	1,172	754	418	....	55.7	568,332	312,705	255,627	.....	81.7	485	415	71	.....	16.9
Ohio Southern	128	128	.....	.....	.....	30,831	24,824	6,007	.....	24.0	241	194	47	.....	24.0
Pennsylvania	1,930	1,890	40	....	2.1	4,108,876	3,856,896	251,980	.....	6.5	2,128	2,040	88	.....	4.3
Peo., Dec. & Evansv.	254	248	6	....	2.4	50,525	51,622	4,903	.....	9.5	223	208	15	.....	7.2
Phila. & Reading	994	994	.....	.....	.....	1,703,469	1,688,802	14,667	.....	0.9	1,714	1,699	15	.....	0.9
Roch. & Pitts.	108	108	.....	.....	.....	21,669	19,296	2,373	.....	12.5	201	179	22	.....	12.5
St. L., A. & T. H., M. Li'e	195	195	.....	.....	.....	93,992	121,937	.....	27,945	22.9	482	625	.....	143	22.9
Belleville Line	121	121	.....	.....	.....	68,850	50,240	18,610	.....	37.3	569	415	152	.....	37.3
St. Louis & San Fran.	660	592	68	....	11.5	253,419	283,399	.....	29,980	10.6	384	479	.....	95	19.8
St. P., Minn. & Man.	910	740	170	....	23.0	858,903	382,642	476,261	.....	124.4	944	517	427	.....	82.6
Scioto Valley	128	100	28	....	28.0	43,343	26,969	16,374	.....	60.6	339	270	69	.....	25.6
South Carolina	243	243	.....	.....	.....	74,249	69,184	5,065	.....	7.3	306	285	21	.....	7.3
Tol., Cin. & St. L.	420	285	135	....	47.4	76,021	48,368	27,653	.....	57.5	181	170	11	.....	6.5
Union Pacific	3,740	3,450	290	....	8.4	2,491,590	2,319,238	172,352	.....	7.4	666	672	.....	6	0.9
Vicks. & Meridian	142	142	.....	.....	.....	30,832	29,281	1,551	.....	5.3	217	206	11	.....	5.3
Wab., St. L. & Pacific.	3,350	2,480	870	....	35.1	1,204,864	1,144,661	60,203	.....	5.2	360	462	.....	102	22.1
Wisconsin Central	520	520	.....	.....	.....	126,357	110,335	16,022	.....	14.6	243	212	31	.....	14.6
Total, 66 roads	49,578	43,982	5,596	....	.....	29,456,793	26,392,314	3,275,553	211,074	.....	594	600	.....	6	.....
Total inc. or dec	.....	.....	5,596	....	12 5	.....	.....	3,064,479	.....	11.6	.....	.....	.....	6	1.0

The oil does not begin to dry vigorously until the seventh day. It gains 11 per cent. in weight in 3½ months, and 3.4 per cent. when heated to 176°.

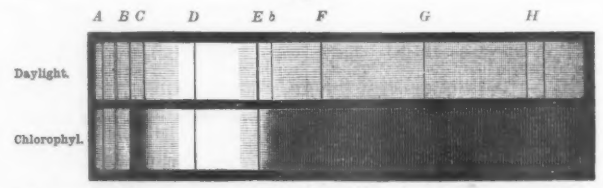
An oil clear of all plant flesh (if such it contain) is, however, desirable for all purposes, especially if it is to be boiled.

Changes Produced by Heat.—Linseed oil acid, oxy-linseed oil acid and dried oil leather all become red when heated. In the sun, however, they all become colorless again. The sun is, therefore, the most active of all purifyers of oil, and it acts with greater advantage when the oil or varnish is spread. One may safely use, in all work exposed to direct sunlight, a dark oil or varnish which will bleach in the sun in a small vial uncorked.

SEPARATED COLORS (SPECTRUMS) OF LEAF-GREEN LIGHT AND DAYLIGHT.*

We can, perhaps, make clear the changes in color in oils by observing the separated colors of the coloring matter, the leaf-green of plants (chlorophyl). It contains (see the

Fig. 19.



lighter surfaces in the cut) much red, very much yellow and green, the bluish green, blue and violet being swallowed up by the plant. Oil is colorless, green, yellow, or red. On our walls as it loses its colorless or greenish cast it turns yellow because there is more red in the color, red and green producing yellow. Although we cannot make a pure and brilliant yellow by mixing together a green and a red light, yet we can produce a yellow, and there is reason to believe that all yellows are a mixture of red and green rays (see Rood's Chromatics, page 116). This will account for so little green and so much yellow in leaf-green separated light. If we heat this dried oil it becomes quite red, that is to say, the green disappears altogether. In the sunlight, however, the red fades away and the oil becomes colorless, but it may in doing so first turn to a yellowish and then to a greenish cast. I am merely supposing the case in order to show the connection between red linseed oil acid and the yellow color of white paint.

Dried oil heated to 176° loses weight and becomes reddish. Apparently the *heat* of the hot sun is sufficient to yellow the oil.

*From Von Bezold on Color. L. Prang & Co.

On the other hand an excess of flying oil acids remaining in the oil may give a brown color.

The yellow color is possibly entirely due to the change in the drying part of the oil. When a soap is made of linseed oil and lime, it quickly becomes red. This is because the linseed oil acid is changed into oxy-linseed-oil acid, which may be even blood red.

Lead soaps do not so quickly redden, but they redden with age, and it is certain that all soap-making between the linseed-oil acid and lead, manganese or zinc is a special cause of such change in the dried oil. The oil acid becomes oxy-oil acid, which is reddened by heat or by the air. For this reason an excess of driers in oil or varnish will discolor the oil when dry, and white lead more quickly becomes yellow, as a paint, than zinc white.*

When drying oils are heated, however, they do not equally darken.

Walnut oil darkens (reddens) least, poppy oil a little more; oil of East India seed perhaps less than American linseed oil from American seed.

One point of difference between linseed oil and walnut and poppy-seed oils is that these contain no palmitin.† It is possible that East Indian seed contains less palmitin than American seed. Palmitin being the original fat of linseed

* "The changes of white lead and linseed oil are rapid and inevitable. A foul tawny yellow quickly overspreads the work, utterly destructive of delicacy and freshness in skies, distant mountains, water, etc. Let it not be supposed that we are adopting any hasty prejudice against white lead and linseed oil, derived merely from some misuse of them. They have always been fatal to these essentials of a landscape." (Mr. Twopenny quoted by Hamerton). *Compare with:*

"In the year 1852 Mr. Holman Hunt painted a picture entirely in zinc white, which *stood perfectly so far as purity was concerned*, but became much more transparent as it dried further in course of time, so that the outline showed through in many places."

† Palmitin as palm oil is colorless or yellow: heated it becomes yellowish brown. The palmitin in *astrocaryum vulgare* of Brazil is a vermilion red. This discussion has the practical purpose of calling attention to the improvement of the seed. Soil is apparently a very important matter. In some parts of France it is necessary to get new seed from Russia every few years: it degenerates so rapidly as no longer to germinate. A light but not dry, sandy loam is probably the best soil. I have been told by the superintendent of a crushing mill that he could detect the seed from a heavy clay soil by the small yield.

oil, the fat most closely connected with the coloring matter, we have here some suggestive facts.

(1) American growers of flaxseed should experiment with various seeds, in order to obtain that variety which will produce an oil having least tendency to change color.

Nearly all the linseed oil now used in this country is grown on our soil—at least 9,000,000 bushels of seed are produced, mostly in Illinois, Indiana, Iowa, Kansas, Missouri and Minnesota. It is not impossible that we may be able to export large quantities of oil, as we are, to some small degree, exporting both oil and varnishes.

21. It is important that no cotton-seed oil get into our linseed-oil and varnishes. The color changes of cotton-seed are probably greater.

In proportion as oils change in color is their tendency to become sticky.

(1) Cotton-seed oil (possibly) which always remains sticky, "tachy"; (2) linseed oil, (3) poppy-seed oil, which more quickly loses its stickiness, although it does not dry so hard, and walnut oil. The drying part of these oils is the same substance (linolein) found in linseed oil; but they do not, perhaps, develop so much oxy-linseed-oil acid, which is very sticky and becomes blood red. All the changes in color may be in some way connected with imperfect, and, in a certain sense, unripe oil.

To sum up the changes in color:

1. There is a difference in drying oils, some changing their color, especially under heat, more than others.

There are, possibly, three sets of color items: (*a*) The turbidness of imperfect oil; (*b*) the reddening of oxy-oil acid; (*c*) the darkening by an excess of flying acids remaining in the oil.

2. The change in color seems, in some considerable measure, due to the oxy-linseed-oil acid, which may become blood-red. All substances, but especially potash and lime, which change the oil into soaps, produce in time red oxy-linseed-oil acid. Strong soaps have more tendency to redden than weak soaps when simply exposed to the air. Therefore all excess of driers or soap-making substances is to be avoided. Krems white contains less soap-making substance than ordinary white lead; and, says Mulder, "for 26 years I have observed that it does not so much change to yellow as does common white lead." Bourier (*Bulletin des Sciences*, 1839) wrote: "A neutral carbonate which I have prepared, mixed with poppy oil, remained unchangeable in darkness."

It is plain why lead changes color more than zinc—it contains more soap. Also it is plain that any lime as an adulteration to lead or zinc will soon greatly discolor the paint.

Again, it is plain that boiled oil, which contains much oxy-linseed-oil acid and much soap, will darken sooner and more completely than raw oil. To avoid change of color, we must avoid that which most quickly dries and hardens the paint—soap. Even manganese driers with zinc white will yellow the paint.

3. It is possible, however, for linseed-oil acid or the hard dried oil leather to redden by heat, or in the shade.

4. All the discolorations of the oil, oil acids, and the dried oil are more or less completely removed by the sun's direct rays. The heat of the sun long continued may, however, yellow the oil.

5. Slowly dried oil containing a large amount of flying oil acids darkens more than oil dried quickly in the sun.

6. *It is important, therefore, for all these reasons, to use as little oil as possible in interior house-painting with white colors.*

It is equally important that the layer of paint should not be thick, so that the oil may get all possible light, and the flying oil acid escape; and it would be well if the paint could be dried by a strong but not excessive heat—not above 80°.

7. Finally, it is possible that the presence of more or less palmitin indicates a more or less perfect oil. The palmitin is apparently made from the coloring matter of the plant, the drying part of the oil from it. By careful selection, it is possible a great improvement in quality of seed could be obtained. This has been a successful method with the sugar beet, etc.

The Raw Oil.—We may now return to the question of purifying the color of the raw oil. Sulphuric acid is used: does it injure the oil? Also alkalies like magnesia: what effect have these?

In reply, all soap making either by acids or alkalies, but especially by the latter, is injurious. If the oil is saponified (unlinked) by acids, it will dry slowly, and change into a darker oil in the shade. Alkalies will improve the drying to a degree, but will tend in time to discolor the oil, if any of the substance remain in it.

Mulder has made a special study of sulphuric acid in its relations to oil. He treated some linseed oil with strong sulphuric acid and spread it upon a surface. It dried as follows:

DRYING LINSEED OIL.

April	8.		0.430 of a gramme.
"	11.	Gain	0.001 " "
"	16.	"	0.020 " "
"	22.	"	0.052 " "
"	26.	"	0.003 " "
"	30.	"	0.002 " "
May	14.	Loss	0.002 " "
"	21.	"	0.006 " "
"	28.	"	0.004 " "
July	26.	Gain	0.002 " "
Dec.	19.	Loss	0.005 " "
Net gain.			14.6 per cent.
Loss by heating			3.0 "
			11.6 per cent.

Oil usually gains not more than 10 per cent. in weight, and keeps, after heating, a gain of 7 or 8 per cent. Oil treated with sulphuric acid gained nearly 15 per cent., and kept after treating nearly 12 per cent. It will be seen therefore, that sulphuric acid does not greatly injure the drying oil, but that it changes the soft, not-drying oil acids so that they take up oxygen, but do not fly away. Sulphuric acid is not a great injury to oil, and it does not (according to Mulder's experiments) cause the oil to change color after it is dry. In fact, it seems to affect only the not-drying oil acids (palmitin and olein), and not to change the drying acids nor to unlink much of them.

The great objection to sulphuric acid in purifying oil is the danger that some of the acid left in the oil may affect white lead or delicate colors of fine pigments. The oil may be tested by litmus paper (to be had of any druggist), which is changed from blue to red by an acid.

Mulder recommends for clearing turbid oil mixing it with its volume of warm water containing common salt.

The following is the advice of a practical varnish maker:

It is known that the fat oils, both drying and non-drying, are obtained by pressing out the plant fibres in which they occur. In consequence of the high pressure many other substances get mixed in with the oil, as plant mucilage, albumen, plant fibres, etc. These are removed by refining.

The refining is usually performed in the following manner: The crude oil is treated with sulphuric acid, which destroys the foreign materials, but leaves the oil unaltered but black in color from the decomposed material. After the oil has cleared again it is decanted from the settlings and washed with water to free it from the acid. According as the refining is more or less carefully performed, the oil contains smaller or greater amounts of foreign materials. These foreign materials hinder the oil from drying (?), and it is advisable to treat the oil with an aqueous solution of such substances as have the property of forming insoluble substances with the above bodies (plant mucilage and plant albumen).

Bleaching the Oil with Copperas (ferrous sulphate) Solution.—Make a solution of 220 lbs. of copperas in 35 gallons of rain water. Place 22 lbs. of oil in a glass flask holding 3½ gallons. Add from four-fifths of a gallon to one gallon of the solution. Place the flask or flasks in a room where they will be exposed to the direct rays of the sun, and shake them at least once a day. If the sunlight is strong the oil will be bleached in three weeks; if less strong, it may require six weeks. The clear oil is carefully decanted from the solution and kept in glass bottles.

The same solution may be several times used; as it becomes weak add more copperas.

Bleaching the Oil by Sulphuric Acid is accomplished in a similar manner to that explained in the second paragraph above—"general refining."

Bleaching with Sulphate of Lead.—Sulphate of lead is a white, insoluble powder, which can be easily made by bringing sulphuric acid together with sugar of lead solution. In order to bleach linseed oil with this preparation, 2 per cent. of the weight of the oil is taken of the lead sulphate and rubbed together with a very small amount of oil on the rubbing stone, until an intimate mixture is obtained, and this is then diluted with more oil to a milk, which is then added to the rest of the oil, which must be in this case also in light glass flasks.

The turbid liquid clears slowly, and after a few weeks the oil is found quite clear and bleached; the foreign materials which were contained in the oil now lie as a fairly solid skin upon the settlings of lead sulphate, which can be used many times for the same purpose.

RAILROAD EARNINGS, FIVE MONTHS ENDING MAY 31.

NAME OF ROAD	MILEAGE. 1882.	1881.	Inc.	Dec	P. c.	EARNINGS. 1882.	1881.	Increase.	Dec.	P. c.	EARNINGS PER MILE. 1882.	1881.	Inc.	Dec.	P. c.
						$	$	$	$		$	$	$	$	
Ala. Gt. Southern	290	290				308,050	295,117	12,933		4.4	1,062	1,018	44		4.4
Atchison, Top. & S. F.	1,794	1,618	176		10.9	5,653,718	4,198,656	1,455,062		34.6	3,151	2,596	555		21.3
Buffalo, Pitts. & West.	205	205				307,963	243,904	64,059		26.3	1,520	1,190	330		26.3
Bur., Cedar Rap. & No.	620	564	56		9.9	1,080,142	791,120	289,022		36.5	1,742	1,403	339		24.2
Cairo & St. Louis	146	146				143,997	173,747		29,750	17.1	986	1,190		204	17.1
Central Iowa	244	190	54		28.4	445,542	300,538	145,004		48.2	1,826	1,582	244		15.3
Central Pacific	2,909	2,599	310		11.5	9,952,144	8,730,543	1,221,601		14.0	3,421	3,359	62		1.8
Ches. & Ohio.	457	435	22		5.1	1,126,686	1,054,987	71,699		6.8	2,465	2,465	40		1.6
Chi. & Alton	847	840	7		0.8	2,807,625	2,610,098	197,527		7.6	3,315	3,107	208		6.7
Chi. & Eastern Ill.	232	220	12		5.5	681,895	615,578	66,317		10.7	2,939	2,798	141		5.0
Chi., Mil. & St. Paul	4,197	3,795	402		10.6	7,520,000	5,388,990	2,131,010		39.5	1,792	1,420	372		26.5
Chi. & Northwestern	3,280	2,792	488		17.4	8,481,788	6,736,275	1,745,513		26.0	2,586	2,413	173		7.2
Chi., St. P., Minn. & O.	1,032	950	82		8.6	1,857,807	1,279 365	578,497		45.2	1,801	1,347	454		33.7
Chi. & West Mich	323	320	3		0.9	602,302	482.071	120.231		25.0	1,865	1,506	359		23.9
Cin., Ind., St. L. & Chi	300	30				1,016,923	919,780	97,143		10.6	3,390	3,066	324		10.6
Cin., N. O. & Tex. Pac	336	336				967,588	804,587	163,001		20.3	2,880	2,395	485		20.3
Cleve., Akron & Col	144	144				192,200	167,833	24,457		14.6	1,335	1,165	170		14.6
Col., Hock'g Vy. & Tol.	320	320				1,049,299	834,371	214,928		25.8	3,279	2,607	672		25.8
Denver & Rio Grande	1,062	607	455		74.9	2,614.171	1,971,527	642,644		32.6	2,462	3,248		786	24.2
Det., Lan. & No.	226	226				636,588	499,231	137,357		27.5	2,817	2,209	608		27.5
Flint & Pere Marq.	345	318	27		8.5	889,412	744,076	145,336		19.5	2,578	2,340	238		10.2
Gal., Har. & San Anto.	245	245				515,335	481,669	33,666		7.0	2,103	1,965	137		7.0
Grand Trunk	1,460	1,408	52		3.7	4,455,734	4,515,191		59,457	1.3	3,052	3,207		155	4.9
Great Western	526	526				2,036,641	2,223,820		187,179	8 4	3,872	4,228		356	8.4
Gr.Bay,Winona & St.P.	220	220				149,229	139,313	9,916		7.2	678	653	45		7.2
Hannibal & St. Jo.	292	292				746,165	817,293		71,228	8.7	2,556	2,799		243	8.7
Houston, E. & W. Tex.	104	86	18		20.9	98,979	52,197	46,782		89.8	922	607	345		67.4
Ill. Cent., Ill. lines	918	918				2,682,520	2,436,095	246,425		10.1	2,922	2,654	268		10.1
Iowa lines	402	402				762,489	613,226	149,263		24.3	1,897	1,525	372		24.3
Ind., Bloom. & West.	555	555				966,302	946,802	19,500		2.1	1,741	1,706	35		2.1
Kan.City.Ft. Scott & G.	328	305	23		7.5	658,173	577,138	81,035		14.1	2,007	1,892	115		6.1
Lake Erie & West	386	386				526,611	497,593	29,018		5.8	1,364	1,289	75		5.8
Long Island	335	320	15		4.9	715,050	634,506	80,544		12.7	2,134	1,983	151		7.6
Louisville & Nashv.	2,025	1,840	185		10.1	4,890,111	4,249,630	640,481		15.2	2,415	2,320	95		4.1
Mar., Hought. & Ont.	88	88				284,134	132,546	151,588		114.4	3,229	1,506	1723		114.4
Mil., Lake Sh. & West.	280	250	30		12.0	337,975	191,736	146,239		76.2	1,207	767	440		57.1
Mo. Pacific lines:															
Central Branch	377	300	77		25.7	326,782	362,877		36,095	9.9	867	1,209		342	28.5
Int. & Gt. No.	775	623	152		24.4	1,105,664	971,759	133,905		13.7	1,427	1,560		133	8.5
Mo., Kan. & Tex.	1,206	884	322		28.6	2,191,423	1,888,617	302,806		16.1	1,817	2,136		319	15.0
Mo. Pacific	853	720	133		18.5	2,679,891	2,425,236	254,655		10.5	3,142	3,368		226	6.7
St. L., Iron Mt. & So.	729	685	44		6.4	2,701,603	2,861,127		159,524	5.6	3,706	4,177		471	11.2
Texas & Pacific	967	749	218		29.1	1,678,112	1,447,141	230,971		16.2	1,735	1,932		197	16.2
Mobile & Ohio	528	506	22		4.3	755,155	981,382		226,227	23.1	1,430	1,939		509	27.0
Nash., Chatta. & St. L.	467	467				767,671	924,675		157,004	16.9	1,644	1,980		336	16.9
N. Y. & New England	396	316	80		25.3	1,240,611	1,009,483	231,128		22.9	3,133	3,195		62	1.9
Norfolk & Western	428	428				850,116	838,241	11,875		1.4	1,986	1,958	28		1.4
Northern Central	326	326				2,168,909	2,174,580		5,671	0.3	6,653	6,671		18	0.3
Northern Pacific	1,012	728	284		39.0	1,899.132	887,210	1,011,922		14.1	1,877	1,219	658		54.8
Pennsylvania	1,926	1,890	36		1.9	18,557,094	17,746,404	810,690		4.5	9,638	9,390	248		2.7
Peoria, Dec. & Evans.	254	214	40		18.7	310,098	225,736	84,362		37.3	1218	1,055	163		15.5
Phila. & Reading	994	994				7,816,766	7,429,793	386,973		5.2	7,864	7,475	389		5.2
Rochester & Pittsb'g.	108	108				109,073	87,428	21,645		25.2	1,010	809	201		25.2
St. L., Alt. & T. H., Main Line	195	195				489,369	594,249		104,880	17.8	2,510	3,047		537	17.8
Belleville Line	121	121				328,274	318,249	10,025		3.2	2,713	2,630	83		3.2
St. L. & San Francisco.	660	592	68		11.5	1,272,623	1,201.417	71,206		5.9	1,874	2,029		155	7.7
St. P., Minn. & Manitoba	910	740	170		23.0	2,774,616	1,542,959	1,231,657		79.8	3,049	2,085	964		45.9
Scioto Valley	128	100	28		28.0	192,249	125,869	66,410		52.7	1,502	1,259	243		19.3
South Carolina	243	243				517,548	524,986		7,438	1.4	2,130	2,160		30	1.4
Tol., Cin. & St. L.	400	285	115		40.5	368,499	230,033	138,466		60.2	921	807	114		14.1
Union Pacific	3,716	3,395	321		9.4	10,916,000	8,371,000	2,545,000		30.2	2,935	2,466	469		19.0
Wabash, St. L. & P.	3,350	2,480	870		35.1	6,261,567	4,918,273	1,243,294		27.0	1,869	1,983		114	5.7
Wisconsin Central	520	520				653,025	462,795	190,230		41.1	1,256	890	366		41.1
Total, 62 roads	49,062	43,665	5,397			137,093,333	117,902,758	20,235,028	1,044,453		2,794	2,700	94		
Total inc. or dec.			5,397		12.4			19,190,575		16.2			94		3 5

Transportation in Congress.

In the Senate on the 1st:

A bill was passed authorizing the New Orleans & Northeastern Railroad Company to build bridges over Pearl River and Lake Ponchartrain.

On motion of Mr. Morrill, a bill was passed to further regulate the investment of the Pacific railroads sinking fund. It permits the Secretary of the Treasury to invest the sinking fund in first-mortgage 30-year bonds of the Union Pacific and Central Pacific railroads.

In the Senate on the 3d:

Mr. Gorman called up the Senate bill to encourage and promote telegraphic communication between America and Europe. It constitutes Robert Garrett, William J. Burns, William J. Frick, of Maryland, and their associates, a company to lay an ocean cable from any point on the American side to some point on the European coast. The bill passed with an amendment extending the time within which the company shall begin laying the cable to two years from the date of the passage of the act. This is the Baltimore & Ohio's proposed cable.

In the course of the debate on the House bill making appropriations for expenses in connection with the death of the late President, Mr. Allison said he felt it to be his duty as Chairman of the Committee on Appropriations to have entered upon the official record the generous response made to the Committee by President Roberts of the Pennsylvania Railroad, declaring it to have been not only a duty but a pleasure to the company to do what it could to increase the comfort and aid in restoring the health of the late President, and disclaiming any intention to ask compensation of the government for courtesies extended on that account. The letter, dated Dec. 28, 1881, was read at the Clerk's desk.

In the House on the 3d:

Mr. Maginnis moved to suspend the rules and pass the Senate bill to accept and ratify an agreement with the Crow Indians for the sale of a portion of their reservation in Montana, required for the use of the Northern Pacific Railroad Company. Agreed to.

To Brake Inventors or Manufacturers.

A number of inquiries have been made at this office for the address of the manufacturers or inventors of the following named brakes: The Fuller & Salvadge brake, the Stone, the Reed, and the Tallman brake. We will be glad to receive the addresses of the parties owning the patents of these inventions.

A "Railroad War."

A crank took possession of a section house on the Detroit, Mackinac & Marquette road yesterday afternoon, and undertook to hold the fort against the company's employés with the aid of a gun and revolver. He caused them some trouble for a time, but was finally taken, brought to this city and surrendered to the sheriff, who now has the bellicose lunatic in charge.—*Marquette Mining Journal.*

RAILROAD GAZETTE

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CONDUCTED BY

S. WRIGHT DUNNING AND M. N. FORNEY.

EDITORIAL ANNOUNCEMENTS.

Passes.—*All persons connected with this paper are forbidden to ask for passes under any circumstances, and we will be thankful to have any act of the kind reported to this office.*

Addresses.—*Business letters should be addressed and drafts made payable to* THE RAILROAD GAZETTE. *Communications for the attention of the Editors should be addressed* EDITOR RAILROAD GAZETTE.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

STANDARD SCREW THREADS.

On another page the report made by a committee appointed by the Master Car-Builders' Association several years ago to investigate the subject of standard screw threads, is printed entire, and although it is of greater length than it is desirable that such reports should be, yet it is believed that it will be to the interest of their employés that railroad managers, superintendents and car-builders should read it. Those who have not the time to read the whole would do well to begin at the ninth paragraph commencing with the words: "Soon after the organization of the Master Mechanics' Association," etc., and read the ten which follow, the last of which ends with the sentence: "There is therefore every reason for adopting Sellers' standard sizes of screw threads for all screws used in car construction."

There is very good reason for believing that the greatest ignorance prevails with reference to screw threads, even among those who ought to know all about the subject. As the committee points out in the report, a large proportion of the master mechanics and master car-builders seem "to have the impression that the Sellers (or Franklin Institute) system consists simply in a standard for the number of threads to the inch" and nothing more. Probably nine-tenths of the men who have charge of the work of making screws and nuts are ignorant or unconscious of the fact, which is also pointed out in the report, that these features are essential to the Sellers system of screw threads:

"FIRST, *screws must have a given number of threads per inch.*

"SECOND, *the threads must be of the form and proportions designated.*

"THIRD, *the diameters of the screws must conform to the sizes specified.*"

Unless all three of these conditions are complied with in the construction of bolts and nuts, it will be impossible to have them so that they will be interchangeable.

The practice which prevails so generally of making bolts "over-size" is one which is especially vicious and should be universally condemned, and seems to be one of these stupid practices into which car-builders and others have drifted through carelessness and indifference. The fact that when it prevails it makes a general interchangeable system impossible would seem to be sufficient to condemn it, but besides this it has the other disadvantage of adding very materially to the cost of the iron used. Manufacturers of iron, of course, do not object to the practice, because it increases the amount of iron they sell from 5 to 10 per cent. The fact, too, as shown in the table published in the report, that a bolt of even or standard size with a Sellers thread is as strong or stronger than one of "over size" with a V thread, takes away all possible advantage which might be attributed to the use of bolts a small fraction of an inch larger in diameter than their nominal sizes. That car manufacturers should persist in this practice, when it results in a dead loss to them on each car they build, is not very flattering to their intelligence.

But some railroad managers or car-builders will say perhaps, We have our system, whatever that may be, in general use on our roads, and to introduce the Sellers system of screw threads, which are not interchangeable with ours, would cause great confusion and expense. Undoubtedly to some extent this would be true. Like all bad habits, this one is not easy to reform, but if the reform is to be brought about it must be commenced at some time. It would be absurd to suppose that standard bolts and nuts would be substituted for those that are not standard on the rolling stock of a road, no matter how few cars or locomotives it might have. The old bolts and nuts must be worn out; but this will not prevent the use of the Sellers standard on all new work. On the Erie road an order to this effect was issued when the system of screw threads was reformed a few years ago, and in all the specifications for rolling stock contracted for it was distinctly stated that the Sellers standard threads should be used, and an inspector was sent to each shop with a set of gauges, with which the bolts and nuts were tested to see whether they were of the right size. Instead of manufacturing the taps and dies in the different shops, as had heretofore been the case, all of the new standard were thereafter bought, and only those were made in their own shops which were required in making repairs on old cars and engines. The result is that the Sellers standard is gradually coming into general use, and the old system, or rather want of system, is at the same time going out as the rolling stock is worn out.

Probably some who read this article, who may be inclined to adopt the standard screw threads, will ask for practical directions indicating how they should proceed to introduce it. The reply to such an inquiry is that the first step to take is to establish a standard of measurement for determining whether bolts and nuts and taps and dies are of the correct dimensions. In other words, the best thing to do is to buy a set of the hardened gauges which the Pratt & Whitney Company is now manufacturing, and put them into the hands of the person in charge of the tool room. These gauges should not be allowed to be used by workmen, but only as standards of reference to maintain correct sizes. The question will then come up whether it will be best for a railroad company to make its own taps and dies or to buy them. A few years ago this was the only thing which could be done, because there were no manufacturers, or very few, who made a specialty of making screw-cutting tools. Of late all this has been changed. There are companies which have invested very large sums of money in special tools and machinery for doing that kind of work. They employ the most skilled workmen and have all the facilities which capital can supply for doing the work to the best advantage. It would therefore be very surprising if they could not make taps and dies for less money than they will cost in a railroad shop which is without, or has few, special facilities. One of the principal companies engaged in the manufacture of screw-making tools has invested over a hundred thousand dollars in special machinery for doing that kind of work. Either that expenditure has been a great waste of money or else it should be able to produce such tools at a much lower price than a railroad company can in its own shops. Those who have investigated the subject are satisfied that at present a railroad company cannot compete in price or quality in this kind of work, or, in other words, that it can buy its taps and dies much cheaper than it can make them. It is not necessary either that a railroad company should be confined to one manufacturer in giving its orders. At the recent convention of Master Car-Builders, the committee which made the report on screw threads was instructed "to procure a set of the unhardened gauges manufactured by the Pratt & Whitney Company, and that these be kept among the archives of the Association as the standard of measurement of screw threads." It is true that what this company has done to establish correct standard gauges has in a great measure secured for them a monopoly in the manufacture of such instruments, but after a railroad company has procured a set of these, it can then buy taps and dies in the open market, stipulating only that they shall conform to the gauges which the action of the Car-Builders' Association has made the standard of measurement for screws.

With reference to the use of over-size screws, the Association on the recommendation of the Committee adopted the following resolution:

"*That this Association deprecates the use of screws larger or smaller in diameter by a small fraction of an inch than the sizes specified for the Sellers or Franklin Institute system, and that all its members are urged to abandon entirely the use of over or under size screws.*"

It is usually very much easier to reform abuses on on railroads from the top downward than the bottom upward. The adoption of the new established standard system of screw threads on a railroad will often subject some master mechanics and car-builders to a little temporary inconvenience, and therefore they will resist the change often with an amount of energy and vehemence worthy of a better cause. A sweeping order from headquarters generally clears away opposition so that it is never heard of again.

If the managers of railroads have any desire to see a uniform and interchangeable system of bolts and nuts adopted, they are urged to issue orders that the Sellers system, as described in the report of the Committee and specified by the action of the Car-Builders' Association, be adopted after the issue of the order, in all new work on their roads. In ordering machinery and rolling stock from manufacturers it should always be specified that the Sellers system of screw threads should be used, and that the bolts and nuts must conform in size to the Pratt & Whitney Company's gauges.

The Car-Builders' Association has now done all in its power to secure the adoption of the Sellers system of screw-threads, and it now remains only for the general managers, superintendents, master car-builders and master mechanics to enforce the recommendations of the Association.

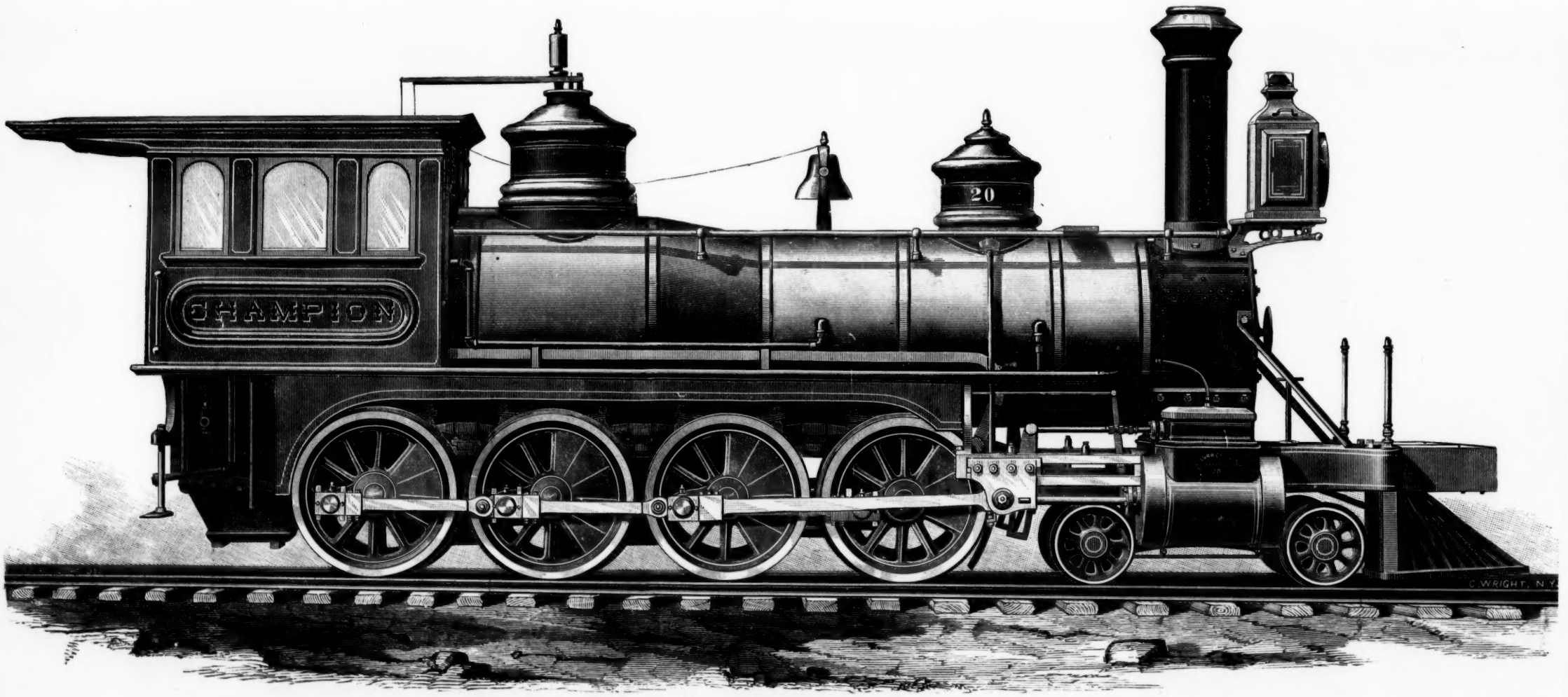
A bugbear has frequently been raised and interspersed as an obstacle in the way of the adoption of an interchangeable system of screws by making the statement that taps will wear so rapidly that it is impossible to maintain a standard. Inquiry of Messrs. Hoopes & Townsend, who are perhaps the largest manufacturers of bolts and nuts in the country, and also at the Baldwin Locomotive Works, elicited the answer that the wear of taps was slight, and the consequent cost of maintaining correct sizes of nuts was hardly worth taking into consideration. The obstructive practical man, therefore, who opposes the adoption of the standard system of screw threads, may be silenced by the statement of the above-named firms, that the cost of maintaining correct sizes is only one-sixteenth, one eighteenth or possibly one-twentieth that of a tap per thousand nuts.

MAY EARNINGS.

May earnings are reported in our table for 66 roads, the largest number we have ever given in one table. These 66 companies worked for the month this year 49,578 miles of road, an increase of 12.5 per cent. over the corresponding month last year, and earned $29,456,793, showing an increase of $3,064,479, or 11.6 per cent. The average earnings per mile this year were $594, against $600 in May, 1881, showing a decrease of $6 per mile, or 1 per cent. More than three-fourths of the increase in mileage was in the far West and Southwest, and most of the new road included this year had probably very light earnings per mile, thus reducing the average considerably. The comparison is with a very good month, as in May of last year the Northwestern roads were still carrying a large traffic, which had been held back by the snow blockades of the earlier months of the year, while the lines carrying through traffic east of Chicago were still receiving good rates, low east-bound rates not beginning until the middle of June, and hardly showing much effect upon the earnings before July.

Of the 66 roads in the table, 13 only show decreases in earnings, the largest being 29.8 per cent. on the Central Branch, 22.9 per cent. on the Main Line of the St. Louis, Alton & Terre Haute, 17.5 on the Nashville, Chattanooga & St. Louis, 15.8 on the Green Bay, Winona & St. Paul, 11.6 on the Cairo & St. Louis, 10.6 on the St. Louis & San Francisco and 10.3 on the Hannibal & St. Joseph. Three of these are unimportant lines with small mileage, and three more are largely dependent on through traffic received from connecting roads.

Twenty-four roads show a decrease in earnings per mile, 11 of these having large increases in mileage this year. The large losses in earnings per mile were 45.5 per cent. on the Central Branch, 22.9 per cent. on the Main Line of the St. Louis, Alton & Terre Haute, 22.5 per cent. on the Denver & Rio Grande, 22.1 on the Wabash, St. Louis & Pacific, 19.8 on the St. Louis & San Francisco, 18.7 on the Missouri Pacific, 15.8 on the Green Bay, Winona & St. Paul, 15.3 on the Kansas City, Ft. Scott & Gulf, 14.7 on the Chesapeake & Ohio, 11.6 on the Cairo & St. Louis, 11.3 on the Central Pacific, 10.5 on the Missouri, Kansas & Texas and 10.3



TWELVE-WHEELED FREIGHT LOCOMOTIVE FOR THE LEHIGH VALLEY RAILROAD.

Built at the Shops of the Company at Weatherly, Pa.

ROBERT H. SAYRE, *Supt. and Engineer.* [*For description see page* 406.] PHILIP HOFECKER, *Master Mechanic.*

on the Hannibal & St. Joseph. Nine of these lines had a large increase in the mileage worked this year, most of the new mileage having but light earnings.

Three roads more than doubled their earnings. The Marquette, Houghton & Ontonagon gained 152.1 per cent., the ore traffic on which it chiefly depends having begun earlier this year than last; the St. Paul, Minneapolis & Manitoba gained 124 per cent., with an increase of 23 per cent. in mileage, and the Columbus, Hocking Valley & Toledo reports a gain of 109.4 per cent. with unchanged mileage. Other large increases in earnings were 97 per cent. on the Houston, East & West Texas, 81.7 per cent. on the Northern Pacific, 60.6 per cent. on the Scioto Valley, 57.5 per cent. on the Toledo, Cincinnati & St. Louis, 45.3 on the Texas & Pacific, 43.1 on the Milwaukee, Lake Shore & Western, 39.3 on the Chicago & Grand Trunk, 38.5 on the International & Great Northern, 37.3 on the St. Louis, Alton & Terre Haute's Belleville Line, 31.6 on the Buffalo, Pittsburgh & Western, 29 on the New York & New England, 24 on the Ohio Southern, 23.8 on the Norfolk & Western (which showed a decrease for several months previously), 23.6 on the Cleveland, Akron & Columbus, 22.1 on the Chicago & Eastern Illinois, 22 on the Missouri, Kansas & Texas and 20.3 per cent. on the Burlington, Cedar Rapids & Northern.

The large increases in earnings per mile were 152.1 per cent. on the Marquette, Houghton & Ontonagon, 109.4 on the Columbus, Hocking Valley & Toledo, 82.6 on the St. Paul, Minneapolis & Manitoba, 66.9 on the Houston, East & West Texas, 39.3 on the Chicago & Grand Trunk, 37.3 on the Belleville Line of the St. Louis, Alton & Terre Haute, 31.6 on the Buffalo, Pittsburgh & Western, 27.8 on the Milwaukee, Lake Shore & Western, 25.6 on the Scioto Valley, 24 on the Ohio Southern, 23.8 on the Norfolk & Western, and 23.6 on the Cleveland, Akron & Columbus.

One road, the Chicago & Alton, had the same earnings per mile in each year, the small increase in mileage corresponding exactly to the increase in earnings.

Eighteen roads had earnings of $600 per mile or over, as follows:

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Northern Central	1,481	Chicago & Alton	653
Eastern	963	Atchison, Top. & S. F.	637
St. P., Minn. & Man.	944	Chicago & Northwest.	627
Central Pacific	786	Cin., N. O. & Tex. P.	620
Col., Hock. Vy. & Tol.	749	Chi. & Eastern Ill.	617
N. Y. & N. England	709	Missouri Pacific	605

Two of these earned over $2,000 per mile; two between $1,000 and $2,000; two between $900 and $1,000; three between $700 and $800, and nine between $600 and $700. The earnings of the Marquette, Houghton & Ontonagon, and the St. Paul, Minneapolis & Manitoba are surprisingly large.

At the lower end of the scale there were 18 roads whose earnings for the month were $300 or less per mile; they were as follows:

Cleve., Akron & Col	$300	Houston, E. & W. Tex.	$222
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Mobile & Ohio.	261	Rochester & Pits.	201
East Tenn., Va. & Ga.	257	Cairo & St Louis	196
Lake Erie & Western	245	Ala. & Gt. Southern	189
Wisconsin Central	243	Tol., Cin. & St. L.	181
Ohio Southern	243	Little Rock & Ft. S.	180
Mil., Lake Shore & W'n	228	Central Branch	150
Peoria, Dec. & Evansv'le	225	Green B., Winona & St. P.	138

Twelve of these earned over $200, and six only less than $200 per mile for the month. Thirty roads earned between $300 and $600 per mile.

Only one of the trunk lines reports for the month, the Pennsylvania, and its earnings show a small increase.

For the five months ending May 31 we have reports from 62 roads, 59 of which also appear in the table for May, while three of them report only for the year. These 62 roads had 49,062 miles in operation, an increase of 5,397 miles, or 12.4 per cent., over last year. Their earnings amounted to $137,093,333, an increase of $19,190,575, or 16.3 per cent., and the average earnings per mile were $2,794, against $2,700 in 1881, an increase of $94, or 3.5 per cent., per mile.

Of these roads 11 show a decrease in earnings and 51 an increase. The large decreases were 23.1 per cent. on the Mobile & Ohio, 17.8 on the St. Louis, Alton & Terre Haute's Main Line, 17.1 on the Cairo & St. Louis and 16.9 per cent. on the Nashville, Chattanooga & St. Louis. The large gains were 114.4 per cent. on the Marquette, Houghton & Ontonagon, 114.1 on the Northern Pacific, 89.8 on the Houston, East & West Texas, 79.8 on the St. Paul, Minneapolis & Manitoba, 76.2 on the Milwaukee, Lake Shore & Western, 60.2 on the Toledo, Cincinnati & St. Louis, 52.7 on the Scioto Valley, 48.2 on the Central Iowa, 45.2 on the Chicago, St. Paul, Minneapolis & Omaha, 41.1 on the Wisconsin Central, 39.5 on the Chicago, Milwaukee & St. Paul, 37.3 on the Peoria, Decatur & Evansville, 36.5 on the Burlington, Cedar Rapids & Northern, 34.6 on the Atchison, Topeka & Santa Fe, 32.6 on the Denver & Rio Grande, and 30.2 per cent. on the Union Pacific. Nearly all these lines have considerable increases in mileage.

Nineteen roads show a decrease in earnings per mile, the most conspicuous being 28.5 per cent. on the Central Branch, 27 per cent. on the Mobile & Ohio, 24.2 on the Denver & Rio Grande (which has an increase of 74.9 per cent. in mileage), 17.8 per cent. on the St. Louis, Alton & Terre Haute Main Line, 17.1 on the Cairo & St. Louis, 16.9 on the Nashville, Chattanooga & St. Louis, 16.2 on the Texas & Pacific, and 15 per cent. on the Missouri, Kansas & Texas. The large gains in earnings per mile were 114.4 per cent. on the Marquette, Houghton & Ontonagon, 67.4 on the Houston, East & West Texas, 57.1 on the Milwaukee, Lake Shore & Western, 54.8 on the Northern Pacific, 45.9 on the St. Paul, Minneapolis & Manitoba, 41.1 on the Wisconsin Central, 33.7 on the Chicago, St. Paul, Minneapolis & Omaha, 27.5 on the Detroit, Lansing & Northern, 26.5 on the Chicago, Milwaukee & St. Paul, 26.3 on the Buffalo, Pittsburgh & Western, 25.8 on the Columbus, Hocking Valley & Toledo, and 25.2 on the Rochester & Pittsburgh, which has still much room for improvement.

Two trunk lines appear in this table, the Pennsylvania with an increase of 4.5 per cent., and the Grand Trunk with a decrease of 1.3 per cent. The roads carrying trunk line traffic generally show decreases, or very small gains. The increases are heaviest on the Northwestern roads, most of which have large increases in mileage, including a good many miles which must have light earnings as yet.

The highest and lowest earnings per mile were as follows:

	Highest.		Lowest.
Pennsylvania	$9,638	Green Bay, Win. & St. P.	$678
Phila. & Reading	7,864	Central Branch	867
Northern Central	6,653	Tol. Cin. & St. L.	921
Great Western	3,872	Houston, E. & W. Tex.	922
St. L., Iron Mt. & S'th'n	3,706	Cairo & St. Louis	986

Only five roads have earnings below $1,000 per mile, and only three are over $4,000, each of those three rising over $6,000 per mile for the five months.

The comparison this year is a fairly favorable one, for, while earnings in the early months of 1881 were reduced by snow blockades, this was largely made up by the rush of traffic in April and May. Rates on through business were generally higher last year, up to the end of May, at least, than this year, and the earnings for the five months were very good.

Very few of the roads published statements of net earnings monthly, and of these even, but three or four have yet made them public for May. Sufficient is known, however, to indicate that expenses have generally been higher than last year, and it is not probable that a table of net earnings would make as favorable a comparison as the statements of gross earnings upon which these comments are based.

The Accident at Little Silver.

In the accident which happened on June 29, near Little Silver on the New York & Long Branch road, a description of which will be found on another page, the coroner's inquest has brought out certain facts:

First, That a switch near the approach of the bridge was incompletely laid.

Second, That one or more of the rails was imperfectly fastened.

Third, That the pile-bridge on which the accident happened was without guard-rails.

If this condition of things was clearly established, and the testimony taken hardly leaves any room for doubt about them, then there seems to be ample justification for the jury's verdict that "the New York & Long Branch Railroad Company," or at any rate some of its employés, were "guilty of gross and culpable negligence."

The following testimony, published in the New York *Sun* of July 4, will indicate the condition of things at the time of the accident:

"Edward T. Welch, a stove dealer, swore that he examined the bridge an hour after the wreck. There was no tie-plate under the switch; there were no braces against the main rails on the ties as there now are, and, except in a single instance, the spikes were nearly six feet apart north of the switch. The strain may have pulled them out. The ties seemed too weak, from holes, to hold the spikes."

"Trackmaster W. H. Marshall, of the New York & Long Branch Railroad, located the cause of the disaster at the switch on the south end of the bridge. This switch had not been completed at the time of the accident. It lacked the slide piece, without which the 4-in. switch points are lower than the 4¼ in. main rails.

"There were plates and shoulder bits in the ground, said he, and no man had a right to put a switch down without putting the plates under it, any more than to take up a rail without having another ready to put in its place."

A company with the kind of traffic that the New York & Long Branch road has which permits trains to run at a high rate of speed over a bridge or trestle, with the track in the condition that that was on the Parker's Creek bridge, is simply inviting disaster. But having said this it seems as though there should be a spontaneous inquiry of what ought to be done about it. Condemnation of the railroad officials or employés will do but little good. No doubt this particular bridge will be made safe, but the lessons which this sacrifice of life and limb should emphasize, because no adequate investigation of the causes which produced the accident has or will be made, will be lost.

In the introduction to "Notes on Railroad Accidents," Charles Francis Adams, Jr., says: "In the case of railroad disasters, the victims do not lose their lives without great and immediate compensating benefits to mankind. * * * The causes which led to the disaster are anxiously investigated by ingenious men, new appliances are invented, new precautions are imposed, a greater and more watchful care is inculcated."

In a certain general sense this is true, but unfortunately the investigations which are ordinarily made in this country are usually of the most incomplete character. In the present instance it was reported that one of the dead bodies of the victims was permitted to remain for hours in the wreck because three rival coroners were quarreling as to which one had jurisdiction and should have the fees for holding the inquest, and at the latter there was a disgraceful wrangle between the coroner and the legal counsel of the company. At nearly all such investigations it is evident that the persons who conduct them, from ignorance of the subject, do not know what questions to ask of witnesses or the direction which should be given to the enquiries. To have any value such investigation must be conducted by experts in railroad construction and operation, which, it is hardly necessary to say, coroners seldom or never are.

But it may be said that the railroad companies themselves make thorough investigations when accidents happen on their lines. The records of such investigations are, however, rarely accessible to the public, and the way in which the evidence is regarded was indicated by the testimony of the President of a prominent line before the Special Committee appointed by the New York Senate to investigate the Spuyten Duyvil accident. The question was asked—

"Can you see any reason why every railroad company operating a railroad in this state should not be obliged to investigate carefully the cause of every accident which results in death or serious injury to human beings; and file written facts and testimony on that subject with some officer of the state, so that it shall be accessible to the public, and accessible to those who desire to prosecute a railroad company for damages, on account of the railroad company's negligence?"

Answer. "It would be showing the hand of the railroad company right to the public, giving them their case; I think it would work great injustice to the railroad company."

What with the ignorance of the coroners and the feeling on the part of railroad affairs that an investigation would in such cases work injustice, there is not much chance that the public will get at the real causes of accidents or that the responsibility will be placed where it properly belongs. In view of this condition of things, and with the article describing the funerals of Mr. Garrison, Mr. Mallory and Mr. Demarest, three of the victims, before us, side by side in the same paper with the evidence taken at the coroner's inquest, the words used by Mr. Adams in the first part of the introduction already quoted from, "that the results which ordinarily flow from the extinguishment of the individual life are pitiably small" have a terrible significance.

But the reader may ask again, what should be done about it? The reply is that there should be some intelligent and competent authority in this state or nation, as there is in Great Britain, delegated and authorized to investigate and make public the causes of railroad accidents. It makes one's blood tingle to think of the ringing condemnation, the clear and precise recommendations and the sharp warning to railroad officers all over the land with which a report made by a British Board of Trade inspector would have closed, if he had been in charge of the investigation at Little Silver. What denunciation it would contain of the practice of operating such a bridge without guard rails! The report would have been, as it were, a red signal flag of danger waved to every railroad manager, superintendent and engineer in the country who is running trains over a bridge not protected with guard-rails or guard-timbers.

There is a little testimony which was published with the rest, which although it has not attracted any attention, seems to have especial significance. Mr. Kingsland, it is said, testified that "on the bridge he saw that the ties were broken *and shoved together*, and some of the rails near the switch were twisted very badly." Now if a train gets off the track on a bridge and the ties "shove together" a disaster is almost inevitable, because the wheels on the truck will fall between the ties, but a car provided with proper check-chains will run a long distance over ties, spaced as closely as they should be on a bridge, if those ties do not shove together. To prevent them doing so it is only necessary to put blocks between them or notch them into the stringers. This is often neglected, and the testimony quoted indicates that such was the case on the bridge over Parker's Creek. If it had not been, the train might have passed over the bridge without injuring any one. If, then, this accident will do no more than to impress upon railroad engineers the need of securing the ties on bridges in the way pointed out, it may be followed by the compensation that in future other accidents of a similar character may be prevented.

Foreign Railroad Notes.

The German Railroad Union, at the close of the year 1880 included 35,040 miles of railroad, an increase of 739 miles during the year. Of this total, 20,898 miles were in Germany, 11,415 in Austria-Hungary, and 2,734 miles in other countries. In Germany 14,066 miles of the Union roads were government roads, in which there was an increase of

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For the five months ending May 31 we have reports from 62 roads, 59 of which also appear in the table for May, while three of them report only for the year. These 62 roads had 49,062 miles in operation, an increase of 5,397 miles, or 12.4 per cent., over last year. Their earnings amounted to $137,093,333, an increase of $19,190,575, or 16.3 per cent., and the average earnings per mile were $2,794, against $2,700 in 1881, an increase of $94, or 3.5 per cent., per mile.

Of these roads 11 show a decrease in earnings and 51 an increase. The large decreases were 23.1 per cent. on the Mobile & Ohio, 17.8 on the St. Louis, Alton & Terre Haute's Main Line, 17.1 on the Cairo & St. Louis and 16.9 per cent. on the Nashville, Chattanooga & St. Louis. The large gains were 114.4 per cent. on the Marquette, Houghton & Ontonagon, 114.1 on the Northern Pacific, 89.8 on the Houston, East & West Texas, 79.8 on the St. Paul, Minneapolis & Manitoba, 76.2 on the Milwaukee, Lake Shore & Western, 60.2 on the Toledo, Cincinnati & St. Louis, 52.7 on the Scioto Valley, 48.2 on the Central Iowa, 45.2 on the Chicago, St. Paul, Minneapolis & Omaha, 41.1 on the Wisconsin Central, 39.5 on the Chicago, Milwaukee & St. Paul, 37.3 on the Peoria, Decatur & Evansville, 36.5 on the Burlington, Cedar Rapids & Northern, 34.6 on the Atchison, Topeka & Santa Fe, 32.6 on the Denver & Rio Grande, and 30.2 per cent. on the Union Pacific. Nearly all these lines have considerable increases in mileage.

Nineteen roads show a decrease in earnings per mile, the most conspicuous being 28.5 per cent. on the Central Branch, 27 per cent. on the Mobile & Ohio, 24.2 on the Denver & Rio Grande (which has an increase of 74.9 per cent. in mileage), 17.8 per cent. on the St. Louis, Alton & Terre Haute Main Line, 17.1 on the Cairo & St. Louis, 16.9 on the Nashville, Chattanooga & St. Louis, 16.2 on the Texas & Pacific, and 15 per cent. on the Missouri, Kansas & Texas. The large gains in earnings per mile were 114.4 per cent. on the Marquette, Houghton & Ontonagon, 67.4 on the Houston, East & West Texas, 57.1 on the Milwaukee, Lake Shore & Western, 54.8 on the Northern Pacific, 45.9 on the St. Paul, Minneapolis & Manitoba, 41.1 on the Wisconsin Central, 33.7 on the Chicago, St. Paul, Minneapolis & Omaha, 27.5 on the Detroit, Lansing & Northern, 26.5 on the Chicago, Milwaukee & St. Paul, 26.3 on the Buffalo, Pittsburgh & Western, 25.8 on the Columbus, Hocking Valley & Toledo, and 25.2 on the Rochester & Pittsburgh, which has still much room for improvement.

Two trunk lines appear in this table, the Pennsylvania with an increase of 4.5 per cent., and the Grand Trunk with a decrease of 1.3 per cent. The roads carrying trunk line traffic generally show decreases, or very small gains. The increases are heaviest on the Northwestern roads, most of which have large increases in mileage, including a good many miles which must have light earnings as yet.

The highest and lowest earnings per mile were as follows:

	Highest.		Lowest.
Pennsylvania	$9,638	Green Bay, Win. & St. P.	$678
Phila. & Reading	7,864	Central Branch	867
Northern Central	6,633	Col. Cin. & St. L.	921
Great Western	3,872	Houston, E. & W. Tex	922
St. L., Iron Mt. & S'th'n	3,706	Cairo & St. Louis	986

Only five roads have earnings below $1,000 per mile, and only three are over $4,000, each of those three rising over $6,000 per mile for the five months.

The comparison this year is a fairly favorable one, for, while earnings in the early months of 1881 were reduced by snow blockades, this was largely made up by the rush of traffic in April and May. Rates on through business were generally higher last year, up to the end of May, at least, than this year, and the earnings for the five months were very good.

Very few of the roads published statements of net earnings monthly, and of these even, but three or four have yet made them public for May. Sufficient is known, however, to indicate that expenses have generally been higher than last year, and it is not probable that a table of net earnings would make as favorable a comparison as the statements of gross earnings upon which these comments are based.

The Accident at Little Silver.

In the accident which happened on June 29, near Little Silver on the New York & Long Branch road, a description of which will be found on another page, the coroner's inquest has brought out certain facts:

First, That a switch near the approach of the bridge was incompletely laid.

Second, That one or more of the rails was imperfectly fastened.

Third, That the pile-bridge on which the accident happened was without guard-rails.

If this condition of things was clearly established, and the testimony taken hardly leaves any room for doubt about them, then there seems to be ample justification for the jury's verdict that "the New York & Long Branch Railroad Company," or at any rate some of its employés, were "guilty of gross and culpable negligence."

The following testimony, published in the New York *Sun* of July 4, will indicate the condition of things at the time of the accident:

"Edward T. Welch, a stove dealer, swore that he examined the bridge an hour after the wreck. There was no tie-plate under the switch; there were no braces against the main rails on the ties as there now are, and, except in a single instance, the spikes were nearly six feet apart north of the switch. The strain may have pulled them out. The ties seemed too weak, from holes, to hold the spikes."

"Trackmaster W. H. Marshall, of the New York & Long Branch Railroad, located the cause of the disaster at the switch on the south end of the bridge. This switch had not been completed at the time of the accident. It lacked the slide piece, without which the 4-in. switch points are lower than the 4¼ in. main rails.

"There were plates and shoulder bits in the ground, said he, and no man had a right to put a switch down without putting the plates under it, any more than to take up a rail without having another ready to put in its place."

A company with the kind of traffic that the New York & Long Branch road has which permits trains to run at a high rate of speed over a bridge or trestle, with the track in the condition that that was on the Parker's Creek bridge, is simply inviting disaster. But having said this it seems as though there should be a spontaneous inquiry of what ought to be done about it. Condemnation of the railroad officials or employés will do but little good. No doubt this particular bridge will be made safe, but the lessons which this sacrifice of life and limb should emphasize, because no adequate investigation of the causes which produced the accident has or will be made, will be lost.

In the introduction to "Notes on Railroad Accidents," Charles Francis Adams, Jr., says: "In the case of railroad disasters, the victims do not lose their lives without great and immediate compensating benefits to mankind. * * * The causes which led to the disaster are anxiously investigated by ingenious men, new appliances are invented, new precautions are imposed, a greater and more watchful care is inculcated."

In a certain general sense this is true, but unfortunately the investigations which are ordinarily made in this country are usually of the most incomplete character. In the present instance it was reported that one of the dead bodies of the victims was permitted to remain for hours in the wreck because three rival coroners were quarreling as to which one had jurisdiction and should have the fees for holding the inquest, and at the latter there was a disgraceful wrangle between the coroner and the legal counsel of the company. At nearly all such investigations it is evident that the persons who conduct them, from ignorance of the subject, do not know what questions to ask of witnesses or the direction which should be given to the enquiries. To have any value such investigation must be conducted by experts in railroad construction and operation, which, it is hardly necessary to say, coroners seldom or never are.

But it may be said that the railroad companies themselves make thorough investigations when accidents happen on their lines. The records of such investigations are, however, rarely accessible to the public, and the way in which the evidence is regarded was indicated by the testimony of the President of a prominent line before the Special Committee appointed by the New York Senate to investigate the Spuyten Duyvil accident. The question was asked—

"Can you see any reason why every railroad company operating a railroad in this state should not be obliged to investigate carefully the cause of every accident which results in death or serious injury to human beings; and file written facts and testimony on that subject with some officer of the state, so that it shall be accessible to the public, and accessible to those who desire to prosecute a railroad company for damages, on account of the railroad company's negligence?"

Answer. "It would be showing the hand of the railroad company right to the public, giving them their case; I think it would work great injustice to the railroad company."

What with the ignorance of the coroners and the feeling on the part of railroad affairs that an investigation would in such cases work injustice, there is not much chance that the public will get at the real causes of accidents or that the responsibility will be placed where it properly belongs. In view of this condition of things, and with the article describing the funerals of Mr. Garrison, Mr. Mallory and Mr. Demarest, three of the victims, before us, side by side in the same paper with the evidence taken at the coroner's inquest, the words used by Mr. Adams in the first part of the introduction already quoted from, "that the results which ordinarily flow from the extinguishment of the individual life are pitiably small" have a terrible significance.

But the reader may ask again, what should be done about it? The reply is that there should be some intelligent and competent authority in this state or nation, as there is in Great Britain, delegated and authorized to investigate and make public the causes of railroad accidents. It makes one's blood tingle to think of the ringing condemnation, the clear and precise recommendations and the sharp warning to railroad officers all over the land with which a report made by a British Board of Trade inspector would have closed, if he had been in charge of the investigation at Little Silver. What denunciation it would contain of the practice of operating such a bridge without guard rails! The report would have been, as it were, a red signal flag of danger waved to every railroad manager, superintendent and engineer in the country who is running trains over a bridge not protected with guard-rails or guard-timbers.

There is a little testimony which was published with the rest, which although it has not attracted any attention, seems to have especial significance. Mr. Kingsland, it is said, testified that "on the bridge he saw that the ties were broken *and shoved together*, and some of the rails near the switch were twisted very badly." Now if a train gets off the track on a bridge and the ties "shove together" a disaster is almost inevitable, because the wheels on the truck will fall between the ties, but a car provided with proper check-chains will run a long distance over ties, spaced as closely as they should be on a bridge, if those ties do not shove together. To prevent them doing so it is only necessary to put blocks between them or notch them into the stringers. This is often neglected, and the testimony quoted indicates that such was the case on the bridge over Parker's Creek. If it had not been, the train might have passed over the bridge without injuring any one. If, then, this accident will do no more than to impress upon railroad engineers the need of securing the ties on bridges in the way pointed out, it may be followed by the compensation that in future other accidents of a similar character may be prevented.

Foreign Railroad Notes.

The German Railroad Union, at the close of the year 1880 included 35,040 miles of railroad, an increase of 739 miles during the year. Of this total, 20,898 miles were in Germany, 11,415 in Austria-Hungary, and 2,734 miles in other countries. In Germany 14,066 miles of the Union roads were government roads, in which there was an increase of

3,430 miles during the year, while 2,296 miles were private roads worked by the government, and there was a decrease of nearly 3,000 miles (to 4,716 miles) in the mileage worked by corporations, so that about 75 per cent. of the whole mileage was worked by governments at the close of the year. Of the 35,040 miles of Union roads only 7,722 miles were double track lines, and the increase of double track during the year was 187 miles. The length of road with three or more tracks was only 38 miles.

The German Railroad Union has as its chief executive not a man but a railroad administration. At least, what it chooses as "executive management" is a railroad administration, its members being not individuals but railroad companies and the management of government roads. For 29 years this place was accepted by the management of the Berlin & Anhalt Railroad, the actual executive being Privy Councillor Fournier, the head of that administration. On the first of July, this administration is dissolved, its road having been acquired by the government, and an election was held for a new "executive management" of the Union, resulting in the choice of the Berlin & Hamburg administration, at the head of which now is Privy Councillor Simon.

The new Austrian province or protectorate of Bosnia is reached from Vienna by an old road of standard gauge 331 miles long to Brood, and a new narrow-gauge road 112 miles long from Brood to Zenica. The trains take 27 hours to pass over the standard-gauge road (12¼ miles an hour), and 13 hours on the narrow-gauge (8.6 miles an hour). An engineer who lately passed over the road explains how so much time is taken on the former. At nearly every local station on the last 65 miles of the road, when rarely was there any one to get on or off, the train stopped, apparently to rest, for about 20 minutes. On the narrow-gauge line (which was built by the Government and is worked by the military authorities) there are many curves of 164 ft. and some of 131 ft. radius. On the best part of the road a regular speed of 14 miles an hour is made, and 20 miles an hour made by some new "twin" engines is spoken of as a remarkable performance. Freight trains of 15 to 20 cars are hauled, the cars having capacity for 13,200 lbs. of load.

The average mileage made by each locomotive on the German railroads in 1880 (including switching and all other movements of locomotives, whether with or without a train) was 17,185 miles; on the Austro-Hungarian roads, 16,009 miles; on the other roads of the German Railroad (chiefly the Roumanian lines and some of the Dutch and Belgian roads, 20,125 miles.

The greatest average on any road in the Union was 26,311 on the Berlin and Dresden; next came the Aussig & Teplitz, in Austria, with an average of 21,756 miles. There were five other roads in Germany and six in Austria whose average was 20,000 miles or more. Excluding the smallest roads (with a total of less than 466,000 locomotive miles—750,000 kilometers) the smallest averages were 12,078 miles on the East Prussia Southern, 12,776 on the Berlin & Görlitz, and 13,090 on the Hungarian Northeastern.

In Prussia recently a company of citizens submitted to the Minister of Public Works plans for a local railroad which it proposed to build, and, in accordance with the law, asked for authority to form a joint-stock company and go on with the work. The minister replied that there was no objection to the plans submitted, but that before authority could be given for a joint-stock company, proof must be given that the whole capital had been subscribed by the incorporators, accompanied by certificates from the magistrates that the signatures were genuine and that the signers had property enough of their own to pay their subscriptions and all the obligations the company might incur! There is some criticism of this answer, but it is the policy of Prussia to limit very strictly hereafter the organization of corporations, in which, as elsewhere, there have been some great evils.

The Austrian Minister of Trade, having been asked by a Bohemian railroad company for authority to put on night trains running at the highest rate of speed, granted the authority on condition that the trains should be equipped with continuous brakes and the locomotives with electric lights. The company is now experimenting with an electric lamp designed for locomotives.

The degree to which the operation of railroads is regulated in Austria may be inferred from the fact that a company which asked permission to run night passenger trains received it on condition that the maximum speed allowed, which has been fixed at 24 kilometres (15 miles) an hour from the day, shall be reduced to 22 kilometres (13⅝ miles) at night!

One of the earliest practical applications of the electri light on a large scale was for lighting the express and baggage rooms and platform at the Paris station of the Paris, Lyons & Mediterranean Railroad in 1877. After a year's trial it was so approved that it was extended to other parts of the station and to the Marseilles station of the same road, where the electric lights have been used ever since, and of the same system (Loutiers) as was employed in 1877.

A Hungarian railroad has established nurseries to provide fruit trees, etc., for planting at stations and by the watchmen's houses along the line, and gardeners are sent around to teach the watchmen and station men how to take care of the trees.

On Cracks and Annealing of Steel.

Master mechanics, locomotive superintendents and locomotive builders will be interested in the paper read before the Institution of Naval Architects by A. C. Kirk on this subject, which is republished on another page. It it does not completely upset, it at least throws great doubts on, the theory that the cracks which occur in steel boiler-plates are due to unequal expansion caused by differences in temperature. The attempt has been made to give greater plausibility to this latter theory by the suggestion that contraction concentrates the strain in the edge of the plate, and that when fracture begins it extends just as a sheet of paper is torn. Both of these propositions were tested by Mr. Kirk and he was unable with the specimens tested to produce a sudden fracture either by expansion and contraction or by concentrating the strains on the edge of the plate. All who are interested in this subject will be repaid for reading his short paper carefully. His conclusion is "that such cracks are simply due to lines of weakness in the plate, which annealing will not cure, although it may easily do harm."

The evidence as to the cause of cracking is however entirely negative in its character. He shows, or has tried to show, what the cracks are *not* due to, but we are still in the dark, so far as his papers are concerned, with reference to the question as to what it is that causes "the lines of weakness." If his theory is correct, then the next step will be to show how to prevent such "lines."

No doubt some of our readers will recall the directions, which in the early history of the use of steel were given for working it, and which if followed would have required so much tenderness of handling and manipulation, that it would have been a serious, if not insuperable, objection to its use. Mr. Kirk recommends exactly the reverse treatment and says that the only test for the lines of weakness is "some rough usage and knocking about." This would lead to the inference that before plates are put into a boiler they should be severely "knocked about" and thus weak places might be discovered by the fracture of the plate, whereas if the weak places do not exist the "knocking about" will not hurt them. The soundness of this view seems to be supported by his experiment, and it certainly would be best to run the risk of occasionally fracturing some plates which are sound, in order to discover those which are defective.

Record of New Railroad Construction.

This number of the *Railroad Gazette* contains information of the laying of track on new railroads as follows:

Atlantic & Pacific.—Extended from Vinita, Ind. Ter., west to Claremore, 26 miles.

Boston, Hoosac Tunnel & Western.—A branch is completed from Mechanicsville, N. Y., northwest to Saratoga, 16 miles.

Chicago & Atlantic.—Track laid from Marion, O., westward 10 miles, and from Lima, O., eastward 15 miles.

Cincinnati, Van Wert & Michigan.—Extended from Latty, O., north to Paulding, 3 miles.

Delaware & Hudson Canal Co.—The *Glens Falls Branch* is extended from Glens Falls, N. Y., north to Caldwell, 9 miles.

Denver & New Orleans.—A branch is completed from Franceville Junction, Col., to Franceville, 4 miles.

East Tennessee, Virginia & Georgia.—The *Macon & Brunswick Division* is extended from McDonough, Ga., north-west to Atlanta, 28 miles. Gauge 5 ft.

East Tennessee & Western North Carolina.—Extended from Hampton, Tenn., east to Cranberry Mines, N. C., 19 miles. Gauge, 3 ft.

Grand Rapids & Indiana.—Extended northward to Mackinaw City, Mich., 6 miles. Branches are completed from Missaukee Junction east to Round Lake, 6 miles, and from Milton Junction west to Luther, 12 miles.

Live Oak, Tamper & Charlotte Harbor.—Track laid from Live Oak, Fla., southward 6 miles. Gauge, 5 ft.

Midland North Carolina.—Track laid from Goldsboro, N. C., westward to Smithfield, 22 miles.

Morgan's Louisiana & Texas.—A branch is completed from Cades, La., northeast to St. Martinsville, 7 miles.

New York, Lake Erie & Western.—A branch is completed from True's Siding, N. Y., east to Lakeville, 1½ miles.

Ohio Southern.—A branch is completed from Jackson, O., northeast to Wellston, 10 miles.

Pennsylvania.—The *Sewickley Branch* is completed from Youngwood, Pa., north by east to Granger, 7 miles, with spurs to Hecla, 1¾ miles, and up Brinkers Run, 1 mile, making 9¾ miles in all.

Pittsburgh, Bradford & Buffalo.—Extended from Tylersburg, Pa., northeast to Marionville, 14 miles. Gauge, 3 ft.

St. Johns & Halifax.—Track laid from Rallstown, Fla., southwest 9 miles.

St. Louis, Des Moines & Northern.—Extended north by west to Boone, Ia., 16 miles. Gauge, 3 ft.

This is a total of 249¼ miles of new railroad, making 4,415 miles thus far this year, against 2,281 miles reported at the corresponding time in 1881, 2,190 miles in 1880, 1,008 miles in 1879, 691 miles in 1878, 689 miles in 1877, 740 miles in 1876, 426 miles in 1875, 690 miles in 1874 and 1,518 miles in 1873.

THE CHICAGO, ROCK ISLAND & PACIFIC road makes an excellent showing for its fiscal year ending with March. With a considerable increase in traffic and a slight increase in rates, the gross earnings showed a gain of 11 per cent., and the net earnings of 12 per cent. The net earnings (with a contribution of $165,000 from the Land Department) were sufficient, after paying all charges and 7 per cent. on the stock, to permit an appropriation of $2,215,000 for new second track and other additions to the property. The gross earnings last year reached $9,719, and the net earnings $4,354 per mile, a high average for a road with so large a mileage of branches. The amount appropriated for improvements in the current year was equivalent to 5¼ per cent. on the outstanding stock, the total net receipts being more than 12 per cent. upon the stock. The fixed charges of the Rock Island road have always been comparatively light, the total bonded debt now being only $17,500,000, or about $14,000 per mile owned, and considerably less than one-half of the amount of stock.

The company has, apparently, ceased to build new road. The only addition to its lines last year was the River Line from Davenport to Muscatine, 26.4 miles, which is really a loop or second track, and is used as part of the main line of the Southwestern Division. Its plans for the current year include only an extension of six miles, to secure a more favorable terminus for one of its branches. Much new work was done, however, in the way of permanent improvements and increasing the capacity of the road for business, and by the end of next year there will be a double track from Chicago to the Mississippi.

The report gives the earnings and expenses of the whole line together, so that nothing can be said as to the proportion of the earnings contributed by the Southwestern line—a point on which there has been some discussion.

In one respect the report is to be commended, and that is for its full statement of road worked and the tenure by which it is held—a matter about which too many companies do not think it necessary to give information. It is also to be commended because the statements are generally condensed, and the information given is not obscured by too great diffuseness.

THE NUMBER OF MEN employed on a railroad is not always easily ascertained, and is a matter of considerable interest. The Rock Island report gives a statement of the number of employés on that road in each month of the fiscal year, the average for the year being 8,627 men on 1,365 miles of road, or 6.32 men per mile of road. In May, 1881, the month when the force was nearest to the average (8,591 men), it was distributed as follows: 41.3 per cent. in the Road Department; 28.2 per cent. in the Machinery and Car departments; 15.1 per cent. in station service; 13.4 per cent. in train service; 1.5 per cent. in the general offices; 0.2 per cent. in the supply office, and 0.3 per cent. in miscellaneous service. The number employed varied considerably, falling from 9,369 in October, when it was greatest, to 7,798 in January, a difference of 1,571. The difference between the highest and the lowest number was naturally greatest in the Road Department, where it was 1,234 less in February than in August, when the work of road repair and renewal is at its height. In the Machinery and Car departments it did not vary greatly, the difference between the lowest and the highest month being only 176 men. The greatest difference in numbers on station service was 286 men, and on train service 361 men, these forces changing with the variations of traffic from month to month. In the general and supply offices the force throughout the year was substantially the same, as might be expected.

SMOKING is prohibited on most railroads, except in the car set aside for that purpose, and no reasonable smoker objects to the strict enforcement of the rule, recognizing the fact that the habit is unpleasant to many people, and that they are entitled to protection. But it is a question whether the smoker, in his turn, is not entitled to protection from the people who do not smoke. On most through trains there is usually plenty of room in the smoking car, but on local, and especially on suburban trains, it is often crowded, and it is a curious fact there will always be found in it a number of persons who do not smoke. Now the smoker has his rights, and a seat in the car is certainly one of them, and, to say the least, it is not pleasant for the suburban traveler, who wants to enjoy his cigar or pipe, to stand up for 10 or 15 miles, while the seats are filled by men who are not smoking, have not been smoking, and have no apparent intention of doing so. While the smoker is shut out from all the cars but one, and makes no objection, non-smokers certainly ought to submit gracefully to a rule excluding them from the smoking car.

CHICAGO RAIL SHIPMENTS EASTWARD for the week ending July 1 (not including the shipments billed through from points west of Chicago) were 16,432 tons, against 18,729 tons in the previous week and 55,864 tons in the corresponding week last year, the decrease from last year being 39,432 tons, or 70.5 per cent. Of the shipments this year 1,095 tons were flour, 8,618 tons grain, and 6,779 tons provisions, the falling off from the previous year being entirely in flour and grain, the provisions showing an increase.

Of the shipments for the week this year the Lake Shore road had 23.2 per cent.; the Ft. Wayne, 20; the Michigan Central, 17.6; the Pan Handle, 15.8; the Grand Trunk, 13.2, and the Baltimore & Ohio, 10.2 per cent. The two Vanderbilt roads together carried 40.8 per cent., and the two Pennsylvania lines 35.8, leaving 23.4 per cent. for the other lines. The Grand Trunk increased its proportion very largely. The shipments were the smallest of the season, except for one week in May.

Some New Passenger Cars.

Increased attention seems of late to have been given to the design and furnishing of passenger cars on Eastern railroads, which heretofore have been charged with being behind the Western roads in this particular. The growth of passenger

traffic within the past two or three years, after several years of stagnation, has doubtless caused an unusual number of new passenger cars to be built; the growth of public taste, as shown in furniture, etc., and of the requirements of comfort have also probably led the railroad companies to pay more attention to the accommodations they offer to passengers.

We have recently received accounts of new cars for several roads, descriptions of which we give together below, premising that three different persons examined the cars and described them, so that any discrepancy in opinions may be accounted for.

NEW YORK, NEW HAVEN & HARTFORD.

The New York, New Haven & Hartford Railroad Company has recently put several new sleeping cars on its line between Boston and New York, which are very beautifully finished, and are provided with every comfort that could be desired. They are finished with mahogany on the inside, have eight berths on a side, with Baker heater and Howard's silver lamps and furnishings. The seats and all the interior is of beautiful design and finish. The ceiling is finished with what may be called a pasteboard head-lining—that is, it is finished in panels formed of heavy pasteboard on which the decoration is painted. The latter is very pleasing, but whether the pasteboard will stand without shrinking or warping only a little more service can determine. There is a water closet and lavatory at each end, and everything is of the most complete character. The cars have six-wheeled trucks with Miller coupler and platform, Westinghouse brake and a new brake-shoe which we were told was designed by Mr. Denver, the Master Car-Builder of the road, to whom the credit of the workmanship on these cars is due.

There is nothing strikingly novel about the cars, but the impression produced by the inside and outside of them is that of great completeness and of excellent taste in their decoration.

The same company has also just finished a drawing-room car for its summer White Mountain travel. At the shops in New Haven the company is having 75 new passenger cars built for its line, which the public, we are quite sure, will agree with us in thinking are or were very much needed on this road. One of these cars is supplied with arm chairs, which are by all odds the most comfortable seats of the kind that we have ever seen. The seat is wide and deep enough for comfort and not too high—a common fault with car seats. The back is shaped so as to conform to the spinal column of a passenger, and has a roll on top which forms a delightful support for the back of one's neck or head. The seats also incline backward enough to keep the occupant settled into them, as it were, without the disagreeable tendency to slide out, which is so common in some of the chairs.

The inside of this car is also finished with mahogany, and is plain and neat. The windows are 3 ft. from centre to centre. Above the main windows there is a smaller opening which is closed with a pivoted sash and glazed with stained glass, which gives the car a rich appearance on the inside.

This car was built for an ordinary coach, the arm chairs being an after-thought. It therefore need not be surprising that the numbers of the seats and windows are not the same, that is, on one side there are 14 seats and 16 windows. Consequently the windows come in relation to the seats "as they happen to," and in some cases the posts and space between the windows come in the way of the line of vision.

The windows instead of blinds have curtains similar to these used in sleeping cars. They are held down by iron rods attached to the lower edges. The rods project beyond the edges of the curtains on the sides, and are held by peculiar-shaped notched grooves cut in the window casing, which is a very neat contrivance.

There are no end compartments, or storm doors, to these cars, but as they are to be used only for summer travel, these are not required.

The cars have four-wheeled trucks with 33-in. Washburn wheels.

BOSTON & ALBANY.

The Boston & Albany Railroad, at its shops at Allston, Mass., has also just completed two very handsome drawing-room cars for the eleven o'clock fast express train to New York, which are described as follows by a correspondent:

"The train is to be composed of one baggage car, one smoking car, two first-class passenger cars and two drawing-room cars, and a trial trip was made to South Framingham by the officials of the road and others a few days ago, to test their qualities and conveniences.

"The drawing-room cars possess some new and attractive features, and are somewhat of a departure from the ordinary style of this class of cars. They were constructed by Mr. F. D. Adams, the Superintendent of the Car Department, under the personal direction of Mr. William Bliss, President of the company. They are very plain in finish, and have plenty of space allowed between the chairs, giving ample room to the occupants. They are built in the most workmanlike manner, and the form and kind of materials used have been selected with a special view to the greatest strength with the least weight. The cars have the Master Car-Builders' standard axles, boxes, etc., and 42-in. paper wheels and weigh, one 45,275 and the other 45,560 lbs., while the Wagner drawing-room cars weigh about 66,000 lbs. each.

"The body of the new car is 57 ft. long from outside to outside of end sills and 9 ft. 3 in. wide from outside to outside of side sills, with 20 windows on each side, 14 with glass 34 in. long by 23 in. wide, and six with glass 34 in. long by 20 in. wide. In car No. 208 there are 26 revolving chairs of rattan of elegant pattern, form and finish, with cushions and arm rests made of the very popular olive tinted leather, stuffed with the very best black curled hair, and four corner seats, making a seating capacity for 30 persons. In car No. 207 there are 24 revolving chairs of the same pattern as those in No. 208. The space occupied by the two additional chairs in car 208 is fitted up for a sleeping compartment with a seating capacity for four, or a sleeping capacity for two, and it has four corner seats (three single and one double) making a seating capacity for 33 persons. A saloon at either end contains elaborate toilet arrangements, the one for ladies and the other for gentlemen. In one end opposite the gentleman's saloon is the heater-room, and this with the saloon forms a perfect finish across the car with a door in the centre, which opens from the drawing-room to the passage way, hung with double-acting spring hinges. The other end is occupied with the ladies' saloon and toilet arrangements, and both form the same complete finish as at the opposite end. The interior finish is of cherry and ash, below the windows cherry and ash combined, above cherry alone, in panels, and the head-lining is of cherry paneled off and beaded very neatly, presenting a very beautiful appearance, in striking contrast to the gingerbread-work so commonly observed in this class of cars, but now becoming quite out of fashion. The cars are heated by Johnson's heating apparatus, lighted at night by four double-burner centre lamps of the Williams & Page pattern of polished bronze and beautifully designed, and all metal ornaments are of polished bronze. The basket racks are particularly fine in design, and the style and finish, not being of the ordinary pattern, attracts attention. The carpets are Wilton of a beautiful pattern, made and put down so that they can be taken up and cleaned each trip with very little trouble.

"There are perforated ventilators over the end windows 8×22 in., and wicket end ventilators in the raised roof, protected by iron netting outside. On each side of the raised roof are 9 'globe' ventilators with registers inside to admit or exclude the fresh air at pleasure. The cars are furnished with four-wheel trucks, having 42-in. paper wheels, quadruple elliptic body springs and Vose's graduated equalizer springs, Miller couplers and platforms, Westinghouse improved automatic brakes, and all the most modern improvements, with fire extinguishers, crow-bars, saws and axes fastened securely (but easily removed in case of necessity) on the inside of the cars for use in case of emergencies. Fortunately for the management of this road these implements have thus far been a useless appendage."

From the description of these cars it will be seen that both the Boston & Albany and the New Haven railroads have abandoned the big windows in these new drawing-room cars. There can be little doubt that such windows are a great absurdity, with no advantages to recommend them, and many disadvantages for which there is no compensation. It may fairly be predicted that they are doomed, as they should be. Car windows are somewhat like tooth-brushes in that each passenger should have one for his own exclusive use. It seems a great oversight, though, that in the cars described, the windows were not arranged with reference to the seats or *vice versa*. One motive which greatly influences many people in travelling is their desire to see the world, and yet notwithstanding this, it happens often that instead of supplying the amplest facilities for doing this, a panel or a post is interposed in the direct line of vision of the traveller who is eager to look at the country.

The neatness and plainness of the Boston & Albany cars is refreshing, and the cool look of the rattan seats in warm weather is a great comfort; but if the manufacturers would study and imitate the shape of the New Haven Company's seats, they might be able to make the backs somewhat less perpendicular, and a good deal more comfortable.

The assertion has been made in these pages before that the arm chairs in drawing-room cars are, like the big windows, a delusion, and it is safe to predict that the public will soon discover this fact, and that some railroad manager or car-builder will soon design a car with seats having reversible backs, similar to those in general use, but giving them more room, which will surpass the chair cars in comfort, and which if run in competition with the latter will ultimately supersede them.

The cars we have described, though, are a great improvement on those heretofore used by the companies which have built them, and are a step in the process of the survival of the fittest.

BOUND BROOK LINE BETWEEN NEW YORK AND PHILADELPHIA.

Some new cars have also been placed on the Bound Brook line between New York and Philadelphia, which are deserving of notice.

The ends are rounded, with platform steps to correspond, affording a wide entrance to the platform.

Each of the four round corners has a (bowed) window, two of which, however, necessarily open into the closets (there are two in each car); the other two are fitted with end seats to match the space; the increased room of these popular seats justifying the change of form, when taken in connection with the increased strength given to the car and the better platform entrance.*

These end seats, however, have the disadvantage of obliging one to face their occupants on entering the closet—which cannot be regarded as a small defect. Just here it may be remarked that the upholsterer of the seats of these cars has never studied anatomy, for he has tufted the upper and lower part of the seat-back to a degree which obliges one to assume the uncouth, limp position of partial paralysis in order to get into comfortable rest. The surest method for making an uncomfortable seat for an upright man or woman, is to tuft it in a fashion which throws the shoulders forward, and the burden of the trunk upon the unsupported small of the back.

The interior of the car is finished in ash and mahogany—the window panels mahogany, carved with a flower and leaves; the frieze in ash cut into "nail heads," of which there is a quadruple row, each head being the square of a finger length and like the face-head of a wrought nail. It is a very pleasing finish and easily kept clean.

The carlines are of a peculiar form, and give the interior a suggestion of the gothic. Each is of the shape of a Λ, the apex extending from the clear-story plate, until the arms, passing through the clear-story sill, reach the inside window panels, extending down these, thus revealing the entire construction. The object attained is the firmer hold upon the clear story, and the prevention of wabbling in any direction. The *Railroad Gazette* is perhaps responsible for this form of construction; it was proposed in an article published Sept. 4, 1875.

The gas fixtures are of brass and very simple and pleasing in form.

The head-linings also are models of their kind, that of the clear story being a ground of cream white, shaded toward its edges with a few gold and black lines. The ceiling head-linings are much the same in some cars; in others the ground is blue or red.

The ventilation is by an end movable sash in the clear-story, which, like its fixed sash, are glazed in a cathedral glass of gold tinge, with dark flowers.

The appointments of the closets are admirable—gas, ventilation for both gas light and room. Nevertheless, through some defect in the gas reservoir, there is a nuisance created, worse than those cured by the excellent appointments.

Every portion of these cars is worthy of study by any one interested in car improvement.

* There may be other reasons. The parlor cars will be on the same plan, but with the advantage of all the windows, as the closets will then occupy another position.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Meetings.

Meetings will be held as follows:

Memphis & Charleston, adjourned special meeting, in Huntsville, Ala., Aug. 22.

Dividends.

Dividends have been declared as follows:

Connecticut River, 4 per cent., semi-annual, payable July 1.

Norwich & Worcester, 5 per cent., semi-annual, payable July 10.

Paterson & Hudson River and *Paterson & Ramapo* (leased to New York, Lake Erie & Western), each 1½ per cent., semi-annual, payable July 5.

Pittsburgh, Fort Wayne & Chicago (leased to Pennsylvania Company), 1¾ per cent., quarterly, payable on special guaranteed stock July 1; on other stock, July 5.

Maine Central, 2 per cent., semi-annual, payable Aug. 15.

Housatonic, 2 per cent., quarterly, on the preferred stock, payable July 15.

ELECTIONS AND APPOINTMENTS.

Atlantic & North Carolina.—At the annual meeting in Morehead City, N. C., June 30, the following directors were chosen by the stockholders: J. A. Bryan, John Gatling, E. Morehead, J. C. Wooten. The old state directors were reappointed.

Baltimore & Ohio.—A circular has been issued by this company announcing that hereafter the Trace Office will be known as the Car-Record Office, of which Mr. D. F. Maroney has been appointed Manager. Mr. Maroney has been connected for some time past with the Chicago, Burlington & Quincy Railroad.

Boston, Concord & Montreal.—Mr. W. A. Stowell has been appointed Superintendent of the Concord Division, from Concord to Wells River. Mr. B. H. Corning is appointed Superintendent of the White Mountains Division, from Wells River to Groveton and Mt. Washington.

Central, of New Jersey.—The new board has elected Henry S. Little, President; John Kean, Vice-President; Samuel Knox, Secretary; J. W. Watson, Treasurer. They are all re-elected.

Central Vermont.—Mr. W. F. Smith, late General Passenger Agent, has been appointed General Eastern Passenger Agent, with charge of all the company's agencies in New York, New England and Canada.

Chicago, Milwaukee & St. Paul.—Mr. H. C. Atkins, Superintendent of the Chicago and La Crosse divisions, has withdrawn his resignation and will retain his position.

Mr. Wm. N. D. Winne has been appointed Assistant General Auditor, with office in Milwaukee.

Chicago, Rock Island & Pacific.—Mr. James Mills is appointed New England Freight Agent, with office in Boston, in place of John Fay, resigned. Mr. Mills was recently with the Boston & Albany.

Green Bay, Winona & St. Paul.—Messrs. E. C. Case, General Freight Agent, and Munson T. Case, General Passenger Agent, having resigned, the duties of those offices will, for the present, be performed by Mr. Timothy Case, General Superintendent.

Kansas, Bloomington & Northwestern.—The directors of this new company are: W. M. Brown, Fall River, Kan.; J. B. Clayton, S. R. Martin, Eureka, Kan.; T. E. Simpson, S. G. Wade, McPherson, Kan.; J. H. Brewer, J. H. Morse, Peabody, Kan.; R. T. Malrood, Osborne City, Kan.

Lake Erie, Wooster & Muskingum Valley.—This company has been organized with the following officers: President, J. H. Kauke; directors, J. H. Clark, C. W. Kauke, Harry McClarran, W. A. Underwood; Secretary, J. N. Clark; Treasurer, H. McClarran. Office at Wooster, Ohio.

Massachusetts Railroad Commission.—The Governor of Massachusetts has appointed Thomas Russell Railroad Commissioner for another term of three years.

New York, Pennsylvania & Ohio.—Mr. J. M. Ferris is appointed Acting General Manager during the absence of General Manager P. D. Cooper, who will be away until Oct. 1 next.

Northern Pacific.—Mr. Herman Trott is appointed General Land Agent, with office in St. Paul, Minn., in place of R. M. Newport, resigned.

Mr. W. J. Brokaw has been appointed Master Mechanic of

the entire Construction Department of the Eastern Division of this road, with office at Forsythe, Montana. Mr. Brokaw was recently Master Mechanic of the Mexican National Railroad in Mexico.

North Shore.—The officers of this company, which takes the Western Division of the Quebec, Montreal, Ottawa & Occidental road are: L. A. Senecal, President; J. B. LaBelle, General Passenger Agent; J. T. Prince, General Freight Agent; S. Shackell, Auditor; A. L. Light, Chief Engineer; W. E. Blumhart, General Storekeeper; F. W. Wurtele, Chief Accountant; W. C. Hall, Assistant Superintendent of Traffic. General offices, Montreal.

Ogdensburg & Lake Champlain.—At the annual meeting in Ogdensburg, June 28, the following directors were chosen: W. J. Averell, Ogdensburg, N. Y.; Horace Fairbanks, St. Johnsbury, Vt.; Darius W. Lawrence, Malone, N. Y.; Peter Butler, Warren K. Blodgett, G. A. Carlton, John S. Farlow, Walter L. Frost, Wm. A. Haskell, Francis M. Holmes, Sterne Morse, Emmons Raymond, J. Thomas Voss, Boston.

Sabine & East Texas.—At the recent annual meeting the following officers were chosen: President, J. F. Crosby; Vice-President, A. H. Viele; Directors, B. D. Crary, T. W. House, A. Kountze, David Van Wagenen, Jacob Van Wagenen; Secretary, W. N. Shaw; Treasurer, W. H. Hollister.

St. Louis, Iron Mountain & Southern.—Mr. Wm. Kerrigan has been appointed Superintendent in place of Mr. E. L. Dudley, transferred to the Texas & Pacific. Mr. J. J. Frey is appointed Assistant Superintendent. Offices in St. Louis.

Salt Lake & Western.—At the annual meeting last week the following directors were chosen: A. F. Doremus, W. W. Riter, LeGrand Young, Salt Lake, Utah; W. B. Doddridge, Evanston, Wy.; S. H. H. Clark, Omaha, Neb.; Frederick L. Ames, Boston; Sidney Dillon, New York.

Sauk Centre Northern.—The directors of this company are now as follows: James J. Hill, R. B. Galusha, W. S. Alexander, Edward Sawyer, St. Paul; J. V. Brower, St. Cloud, Minn. Mr. W. R. Gillis is Chief Engineer, with office at Sauk Centre, Minn. The road is controlled by the St. Paul, Minneapolis & Manitoba Company.

Texas & Pacific.—The following order from Superintendent E. L. Dudley is dated July 1:

"From above date the Trans-Continental Division, the Southern Division and Shreveport Division, between Marshall and Shreveport, will be consolidated and known as the Eastern Division of the Texas & Pacific Railway.

"The Eastern Division will end at east switch of Fort Worth yard. Fort Worth will be included in the Rio Grande Division.

"Mr. H. R. Irvine, Division Superintendent, will be in charge of the Eastern Division, with office at Longview Junction, and Mr. T. W. Clawson Train-Master, with office at Texarkana.

"The New Orleans Division will include the road from Shreveport, La., to Cheneyville; Mr. S. G. Eddy Train-Master, with office at Shreveport."

Toledo, Cincinnati & St. Louis.—Mr. A. J. Love has been appointed Master of Transportation of the Cincinnati Northern Division. He was recently Train Dispatcher on the Cincinnati, Hamilton & Dayton.

Trunk Lines Arbitrator.—A circular from Commissioner Fink says:

"The vote of the Joint Executive Committee taken as per Circular No. 353, has resulted in the election of Mr. Charles Francis Adams, Jr., as Arbitrator, for the term of one year, commencing on June 1, 1882, and in the adoption of the plan for the settlement of all questions of difference between the members of the Joint Executive Committee, submitted for approval as per the above mentioned circular. Mr. Adams has accepted the appointment."

Union Pacific.—Mr. W. S. Wing has been appointed Auditor of Passenger Accounts, with office at Omaha. The office of Ticket Auditor has been abandoned. All reports and communications relating to passenger accounts should be addressed to the Auditor of Passenger Accounts.

Winchester & Strasburg.—At the annual meeting, July 5, the following were chosen: President, Robert Garrett; directors, John Gregg, George A. Hupp, J. A. Sherrard, Hugh Sisson, Thomas Whitridge. The road is leased to the Baltimore & Ohio.

PERSONAL.

— Mr. J. M. Hannaford, General Freight Agent of the Northern Pacific, was married at St. Albans, Vt., June 21, to Miss Kittie L. Foster, of that town.

—Mr. P. D. Cooper, General Manager of the New York, Pennsylvania & Ohio road, has been given leave of absence until October 1 next, on account of ill health.

—Mr. R. M. Newport, General Land Agent of the Northern Pacific Railroad, has tendered his resignation to take effect July 1. It is said Mr. Newport will assume the position of Insurance Commissioner for the state of Minnesota.

—A Louisville dispatch says: "It is understood that the resignation of Gen. E. P. Alexander, First Vice-President of the Louisville & Nashville road, is the hands of President Baldwin, but no action has been taken on it. General Alexander has been asked to withdraw it."

—Col. W. R. Hyde, a civil engineer formerly in the employ of Central Pacific Company, died recently at Castor, Idaho. Of late years he had given his attention principally to mining. Col. Hyde was a member of the American Society of Civil Engineers, and a life-member of the California Academy of Sciences.

— Mr. Ashbel Welch, President of the American Society of Civil Engineers and one of the oldest and most respected engineers in this country, has been appointed by the Governor of New Jersey a member of the commission which is to examine and report on the available water supplies of the state, and the best method for preserving and utilizing them, with especial reference to the supply of the cities of the state.

—Mr. W. R. Garrison died at Long Branch, July 1, from injuries received in the railroad accident near that place a few days before. He was a son of Commodore C. K. Garrison, and was, from an early age, interested in his father's railroad plans and properties. He had been a director and President of the Missouri Pacific, director of the New York City & Northern, President of the Metropolitan Elevated and a director of the Manhattan Company. He was largely interested in the elevated roads in New York on his own account, having been connected with them almost from the beginning.

—Hon Ichabod Goodwin, for many years a merchant of Portsmouth, N. H., died in that city, July 4, aged 86 years. He was the first President and for years a director of the Eastern Railroad in New Hampshire, a member of the first board of directors of the Portland, Saco & Portsmouth Railroad, and President of the corporation from 1847 to 1871, and for many years a director of the Eastern Railroad Company. He was a delegate to the National Conventions which nominated Clay, Taylor and Scott for the Presidency. He was several times a Whig candidate for Congress, and was once nominated by that party for Governor of New Hampshire when they were in a hopeless minority. He was elected Governor by the Republicans in 1859 and 1860, his last term expiring in June, 1861.

TRAFFIC AND EARNINGS.

Railroad Earnings.

Earnings for various periods are reported as follows:

	1882.	1881.	Inc. or Dec.	P.c.
Six months ending June 30:				
Col., H. Vy. & Tol.	$1,265,704	$1,038,646	I. $227,058	21.9
Denver & R G.	1,151,633	2,555,757	I. 595,876	23.3
Long Island.	921,859	811,351	I. 110,508	13.6
Rochester & Pitts.	135,944	105,539	I. 30,405	28.7
St. L. & San Fran.	1,512,800	1,460,900	I. 51,900	3.6
Month of June:				
Col., H. Vy. & Tol.	$216,404	$204,278	I. $12,126	5.9
Denver & R.G.	537,462	584,230	D. 46,768	8.0
Long Island.	206,809	176,845	I. 29,964	16.9
Rochester & Pitts.	26,571	18,111	I. 8,460	47.0
St. L. & San Fran.	241,100	260,100	D. 19,000	7.3
Third week in June:				
Chi. & Gd. Trunk.	$38,169	$28,273	I. $9,876	35.3
Chi. & Alton.	108,266	108,005	I. 261	0.2
Chic., Mil. & St. P.	363,000	390,594	D. 27,594	7.1
Great Western.	95,260	93,835	I. 1,425	1.5
Hann. & St. Jo.	36,770	44,554	D. 7,784	17.3
Louis & Nash.	102,880	186,000	I. 6,880	3.7
St. P., Minn. & Man.	194,289	91,010	I. 103,279	113.5
Wabash, St. L. & P.	297,065	357,760	D. 60,695	17.0

Grain Movement.

For the week ending June 24 receipts and shipments of grain of all kinds at the eight reporting Northwestern markets and receipts at the seven Atlantic ports have been, in bushels, for the past six ye rs:

		—Northwestern shipments.—			
Year.	Northwestern receipts.	Total.	By rail.	P. c. by rail.	Atlantic receipts.
1877.	2,029,971	2,627,653	781,921	29.8	2,431,213
1878.	3,851,821	2,624,876	824,773	31.4	3,788,708
1879.	4,268,973	3,747,455	1,876,488	50.1	4,989,473
1880.	5,611,004	6,663,080	2,307,100	34.5	10,576,372
1881.	7,252,434	7,456,759	3,566,702	47.8	5,963,626
1882.	2,582,691	3,256,794	1,171,451	36.0	2,639,414

The Northwestern receipts are the smallest since 1877. Northwestern shipments are smaller than for any corresponding week since 1878, while the Atlantic receipts are the smallest since 1877, and only about one-fourth of those for the corresponding week in 1880. Compared with the previous week of this year there was a decrease of 1,061,000 bushels in Northwestern receipts, a decrease of 13,000 bushels in Northwestern shipments, and an increase of 189,000 bushels in Atlantic receipts.

Of the Northwestern receipts Chicago had 52.9 per cent., St. Louis 12.4, Peoria 10.4, Milwaukee 9.4, Toledo 7.0, Detroit 3.9, Cleveland 2.1 and Duluth 1.9 per cent.

Of the Atlantic receipts New York had 68.2 per cent., Philadelphia 9.1, Montreal 7.3, Baltimore 6.5, Boston 5.8, New Orleans 2.7 and Portland 0.4 per cent.

For the week ending June 28 the exports were 849,609 bushels of grain and 19,962 barrels of flour, against 808,790 bushels of grain and 48,874 barrels of flour in the preceding week.

Buffalo receipts by lake from the opening to June 30 were as follows, flour in barrels and grain in bushels, flour reduced to wheat in the totals:

	1882.	1881.	Inc. or Dec.	P. c.
Flour.	422,423	285,985	I. 116,438	40 7
Grain.	15,491,502	18,438,588	D. 2,949,086	16.0
Total, bushels.	17.504.017	19,868,513	D. 2.364,496	11.9

The June receipts (flour reduced to wheat) this year were 5,901,813 bushels, against 12,020,059 bushels in June, 1881, a decrease of 6,118,246 bushels, or 50.9 per cent.

Shipments eastward by canal of grain received by lake were as follows up to June 30, in bushels: 1882, 9,128,907; 1881, 9,076,359; increase, 52,548 bushels, or 0.6 per cent. The canal opened April 11 this year and May 17 last year.

Baltimore grain receipts in June were as follows, flour in barrels and grain in bushels, flour reduced to wheat in the totals:

	1882.	1881.	Decrease.	P. c.
Flour.	79,454	107,602	28,148	26.2
Wheat.	392,890	2,186,629	1,853,739	84.8
Corn.	250,817	1,756,786	1,505,969	85.7
Other grain.	90,542	169,447	78,905	46.7
Total grain.	674.249	4,112,862	3,438,613	83.6
Total, flour reduced to wheat.	1,071,519	4,650,872	3,579.353	77.0

Other grain this year included 89,592 bushels of oats and 950 bushels of rye. June exports this year were 35,767 barrels and 300 sacks of flour and 122,889 bushels of grain.

Coal Movement.

Coal tonnages for the week ending June 24, are reported as follows:

	1882.	1881.	Inc. or Dec.	P. c.
Anthracite.	688,060	475,058	I. 212,942	42.7
Semi-bituminous.	78,496	104,065	D. 25,569	24.6
Bituminous, Penna.	60,982	50,041	I. 16,941	33.9
Coke, Penna.	45.977	31,388	I. 14.589	46.5

It is said that there are indications that the Cumberland strike will soon be over. The Clearfield strike is only partial, and is not expected to last long.

The coal tonnage of the Pennsylvania Railroad for the week ending June 24, was: Coal, 179,188; coke, 45,977; total, 225,165 tons. The total tonnage this year to June 29 was 5,340,723 tons.

Erie Canal.

The business of the Erie Canal at Buffalo from the opening to June 30, was as follows:

	1882.	1881.	Inc. or Dec.	P. c.
Boats cleared.	2,057	1,710	I. 347	20.3
Tolls collected.	$101,189	$94,610	I. $6,579	7.0
Average per day.	1,265	2,150	D. 885	41.2

The canal opened April 11, in 1882, and May 17, in 1881, giving 36 days more of navigation this year.

Omaha and Council Bluffs Tickets.

Mr. C. S. Stebbins, General Ticket Agent of the Union Pacific Railway, has sent the following circular to general passenger and ticket agents of connecting roads:

"Information has been received from connecting lines that a circular has been issued by the Kansas City, St. Joseph & Council Bluffs Railroad requesting that the proportion accruing between Councils Bluffs and Omaha on tickets reading over this company's lines from Council Bluffs in connection with the Kansas City, St. Joseph & Council Bluffs Railroad be reported to the latter road. That circular was issued without the knowledge or consent of this company and without any consultation whatever with us on the subject. No copy thereof was furnished us. Such division of business would be a violation of a well-known rule of the National Association, and we protest against any tickets reading over this company's line being reported to another road without our special consent."

Refrigerator Cars to Colorado.

The Atchison, Topeka & Santa Fe Company gives notice that it will place Anderson refrigerator cars on its line for the transportation of perishable freight to points in Kansas, Colorado and New Mexico. Car-load freight in these cars will be carried through from Chicago and St. Louis to destination without change.

New York Canal Traffic.

For the week ending June 24, the business of the New York canals was:

	1882.	1881.	Decrease.	P.c.
Tons shipped.	189,914	267,891	77,977	29.0
Miles cleared by boats.	238,265	358,212	99,947	27.9
Tolls.	$19,422	$32,160	$12,738	39.6

Leading freights were:

	1882.	1881.	Ind. or Dec.	P.c.
Lumber.	61,554	81,246	D. 19,692	24.2
Grain.	25,282	53,883	D. 28,601	54.0
Iron and iron ore.	18,282	31,441	D. 13,159	40.2
Salt.	1,127	4,765	D. 3,638	76.2
Stone, Lime and clay	17,185	10,943	I. 6,242	57.0
Coal.	48,609	62,700	D. 14,091	22.5
Sugar and molasses.	455	2,653	D. 2,198	83.0
Domestic woolens and cottons.	11	1,797	D. 1,786	99.4

In this week last year the canal had to meet the competition of the railroad war on east-bound freight, but not on west-bound, the rates on which were not reduced until August.

Passenger Rates.

It is reported that the passenger agents in Cleveland have been cutting rates a good deal on tickets from that point to stations in Colorado and points on the Pacific roads. The affair is not considered serious, though some noise has been made about it. Orders have been given to the Cleveland agents to stop the cutting.

Lake Superior Iron Ore.

Shipments of iron ore from Lake Superior Region to June 28 are reported as follows by the Marquette *Mining Journal:*

	1881.	1881.	Increase.	P. c.
L'Anse.	15,679	12,553	3,126	24.8
Marquette.	331,500	159,118	172,391	108.4
Escanaba.	593,299	377,430	215,869	57.2
St. Ignace.	8,930	.....	8,930	.....
Total.	949,417	549,101	400,316	72.7

Part of the very large increase reported is due to the earlier opening of navigation this year.

Of the Escanaba shipments this year 233,007 tons were from the Marquette District, and 360,292 tons from the Menominee District.

In addition to the shipments above there were 20,008 tons of ore delivered to local furnaces and 1,135 tons of quartz shipped.

Pig iron shipments this year were 1,269 tons from Marquette, and 983 tons from St. Ignace, 2,252 tons in all.

Pacific Through Freights.

Shipments of through freight eastward from California points in May were, in tons, as follows:

	Central Pacific.	Southern Pacific.	Total.
San Francisco.	4,810	4,041	8,851
Interior points.	2,724	8,154	10,878
Total.	7,534	12,195	19,729

It will be seen that the Southern Pacific carrried much the larger share from interior points, the excess being chiefly flour and and wheat.

Erie Milk Shipments.

The Middletown *Argus* says: "On Monday night last the two Erie Railroad milk trains carried more milk into New York than upon any other night within the history of the road. The total shipment was 5,350 cans or 53,500 gallons. This is more milk than any other two roads entering New York brought into the city on that night, and proves conclusively that Orange County is the banner milk-producing county from which the city obtains its supply of the lacteal fluid. The average shipment for the past two weeks has been between 4,700 and 4,900 cans, but it is expected that for some weeks to come the average will be upwards of 5,400."

Terminal Charges at Atlantic Ports.

At the meeting of the Trunk Lines Executive Committee in New York, June 29, it was decided to make the terminal charges on grain uniform at all the Atlantic seaports, at 1¼ cents a bushel for elevating and storage. The new rates will go into effect on July 10.

Iowa Trunk Lines Association.

At a meeting held in Chicago, June 29, the subject of admitting the Missouri Pacific's Omaha line into the pool and what percentage of the business it should be allowed formed a theme of discussion, but no definite action was taken. The question of admitting the Chicago, Milwaukee & St. Paul's Council Bluffs line was also informally discussed, but action was postponed until the line is ready for business.

The question of stopping the diversion of business *via* the Seneca Route was also discussed. The Commissioner was instructed to notify the Rock Island that it should make some arrangement by which the Council Bluffs business *via* the Seneca route can be protected and properly accounted for in the pool. New rates based upon the new west bound rates from the East were agreed upon to go into effect July 1. Some minor changes in the classification were also made.

Differential Passenger Rates.

The following circular to the managers of the Western lines has been sent out by Commissioner Fink:

"The Passenger Committee of the trunk lines have had under consideration the adjustment of differential fares, and, although they have not arrived at any final conclusion, the following is submitted for the consideration of the members of the Joint Executive Committee interested in the subject:

"The differential fares are to be adjusted according to the value of the accommodations furnished to the public by the different roads and the different trains on the same roads.

"Accordingly, it is proposed to make the fares as follows: From Chicago to New York—trains without through cars and ordinary time, $20; trains with through cars and ordinary time, $21; trains without through cars and quick time, $22; trains with through cars and quick time, $23 to $25. The quick time from Chicago to New York is about 26 to 30 hours, and the ordinary time is about 37 hours, according to present schedules.

"From St. Louis to New York—no through cars and or

dinary time, $24.25. Through cars and ordinary time, $26.25. All trains from St. Louis on present schedules can be classified in these two classes, except the trains from St. Louis *via* Cincinnati and *via* Chicago.

"It is a question to be considered whether hotels [ticket offices] upon these routes should not be withdrawn to prevent scalping. The ordinary time from St. Louis to New York, under present schedules, is about 39 hours.

"From Cincinnati to New York—No through cars and ordinary time, $18; through cars and ordinary time, $19; through cars and quick time, $20.50. through cars and slow time, $17; no through cars and slow time, $16. All trains on present schedules can be classified under three heads, The ordinary time from Cincinnati to New York is about 26 hours and quick time about 24 hours, and the slow time from 32 to 34 hours. Second class trains from Cincinnati to New York—Quick and ordinary time, $16; slow time, $14.50

"The above adjustment of rates, according to the accommodation furnished to the passengers on different trains, is submitted for the consideration of the members of the Committee, who are expected to act upon the same at their next meeting, to be called for that purpose, and for the purpose of perfecting the agreement for the division of passenger traffic.

"It is requested that the matter be thoroughly considered by the members of the Committee before the meeting, so that prompt action may be taken. How these differential rates are to be put in practice is also to be further considered. No difficulty presents itself in regard to passengers taking trains at points where the differential rates are established, but it will be difficult to arrange for through passengers from points beyond, and you are requested to take this matter into consideration and suggest such plans as you may deem practicable. The question of grading the differential fares from intermediate points will also have to be further considered."

THE SCRAP HEAP.

Locomotive Building.

The Brooks Locomotive Works in Dunkirk, N. Y., are busy on a heavy order for engines for the new Chicago & Atlantic road. The order is for 40 engines.

The Dickson Manufacturing Co. at Scranton, Pa., is busy on orders for the New York, Lackawanna & Western and other roads.

The Fontaine Locomotive Co. has been organized in Detroit with a capital stock of $1,000,000, to build locomotives under the Fontaine patents. The officers are: President and Treasurer, D. M. Ferry; Vice-President, O. W. Shipman; Secretary, Anson Waring.

Car Notes.

The new drawing-room cars now in course of construction at the Philadelphia & Reading car shops, in Reading, when completed, will present a very handsome appearance. The body of the car, not including the platform, will be 60 ft. in length, each car having 14 chairs, and provided with a smoking room at each end with a seating capacity for 12 persons. The interior of these cars will be finished in style similar to those recently turned out of the shop for the Bound Brook Division. Mahogany and other fine grains of wood will be used, and the carving is to be of the most elaborate description. They will resemble the Pullman drawing-room cars in many respects. These new cars will be 10 ft. longer than any cars that have ever been built by the Reading Company. Each car will also be provided with a wash room. The body will rest on six-wheel trucks, something new on the Reading road.—*Pottsville (Va.) Miners' Journal.*

The Baker Car Heater Co. has been organized at Pittsburgh with $500,000 capital stock. The officers are Wm. C. Baker, President; Ralph Bagaley, Treasurer; C. H. Jackson, Secretary. The company has secured a new building, 75 by 100 ft. in size, in Pittsburgh, and will engage in the manufacture of steam heaters for railroad cars under the Baker patents. The company begins business with orders for some $50,000 worth of heaters.

The Baker Car Heater Company has received orders to equip with its improved heater 60 new passenger cars which the Pullman Car Works are now building for the New York, West Shore and Buffalo road.

Bridge Notes.

The co-partnership heretofore existing between George C. Bell, S. J. Fields and James S. Metcalfe, under the firm name of the Niagara Bridge Works, of Buffalo, has been dissolved, George C. Bell purchasing the interest of Mr. Metcalfe. The accounts of the late firm will be settled and the business continued under the same name by George C. Bell and S. J. Fields.

The Wrought Iron Bridge Co. at Canton, O., reports a number of contracts on hand, and its shops are full of work.

Iron and Manufacturing Notes.

The Riggs Forge at Stockholm, N. J., has been started up and is running full time.

The Lebanon Paving Co. has been reorganized with a capital of $500,000. The company has works at Pottstown, Pa., for making tiles, etc., out of furnace slag, and will soon enlarge them.

Port Oram Forge, at Port Oram, N. J., is busy, turning out blooms to fill several large orders.

The property of the Allentown Rolling Mill Co. at Allentown, Pa., was sold last week under foreclosure of mortgage, and bought for $750,000 by the agents of the bondholders.

Mr. Edward S. Moffitt, late manager of the Pardee Furnace, at Stanhope, N. J., has been appointed Assistant General Manager of the Lackawanna Coal & Iron Co., and will have special charge of that company's blast furnaces. Mr. Moffitt is a graduate of the Columbia College School of Mines, and served during the war in the Ninth New Jersey Regiment and afterwards in the Signal Corps.

In the rolling mill at Phœnixville, Pa., a few days since, a bar of ¾-in. round iron 136 ft. long was made. It is said to be the longest bar of that size ever made.

The Rockaway Rolling Mill, at Rockaway, N. J., is running on heavy orders for muck bar, and is also turning out steel blooms on orders.

The new Ella Furnace at West Middlesex, Mercer County, Pa., is completed and will soon go into blast.

The Rail Market.

The market for steel rails is very quiet and not easy to quote. Sales of small lots are noted at $49 to $50 per ton at mill for heavy sections and $51 to $52 for light rails. Large orders could probably be placed lower. The present week is almost a dead week as far as business is concerned.

Iron rails are dull and nominal at $44.50 to $48, according to weight of rail.

Spikes are unchanged at $3 to $3.10 per 100 lbs.; fish-plates, $2.50 to $2.60; track-bolts, $3.75 to $4.

Old iron rails are more active, and Philadelphia quotations are $26.50 to $27 per ton for tees, and $28 for double-heads.

The Iron Strike.

There is but little change to report during the week in the condition of affairs at Pittsburgh and Cleveland, where the strike now centres. Both parties are reported to be weakening and preparing to give way; but these reports come from interested sources, and are hardly worthy of much confidence, except as they may perhaps indicate a growing disposition to compromise. It seems now most probable that the strike will end in a compromise, but how soon it may come it is impossible to say.

Attempt at Train Wrecking.

A dispatch from St. Joseph, Mo., July 3, says: "An eastbound train on the Kansas City, St. Joseph & Council Bluffs road came near meeting with an awful calamity. The train, a passenger, with eight or ten cars well loaded, was going at the rate of 30 or 40 miles an hour, and a short distance this side of Amazonia the train was signaled by an old German, and, coming to a stop just in time, it was found that two rails had been raised and were loose and out of place. The spot was on a high embankment, and had it not been for the old farmer, who accidentally saw it, one of the most horrible wrecks would have occurred."

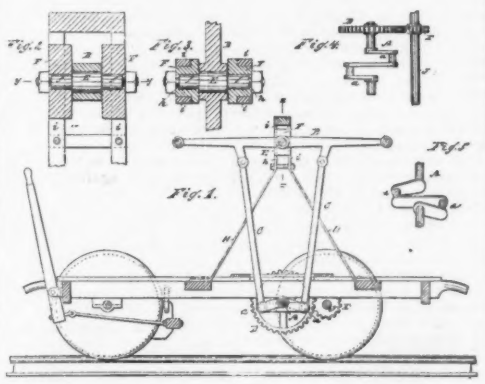
Prizes for Engineering Essays.

At the June meeting of the Engineers' Club of Philadelphia, the Committee of Award (Messrs. Fred. Graff, George Burnham, Jr., and Henry G. Morris) of "the prize offered by a Member of the Club, May, 1881," reported that they had carefully considered the papers submitted for competition, and had awarded the prize of $50 for the paper upon a subject in strictly Mechanical Engineering, to Mr. Wilfred Lewis, of Philadelphia, for his paper on the "Application of Logarithms to Problems in Gearing;" and $50 for the paper upon a subject in Civil Engineering, to Mr. P. H. Baermann, of West Troy, N. Y., for his paper on "What Thickness of Metal Should be given to Cast Iron Pipes Under Pressure;" these being the two papers which, in the judgment of the Committee, conformed the most nearly to the requirements indicated by the rules heretofore published for its guidance.

Sessions' Improved Hand-Car.

Mr. Henry Sessions, of Palestine, Texas, has patented an improvement in hand cars, the object of which is to so construct the cranks and levers "that the maximum amount of the power exerted upon the levers by the operators will be applied to the propulsion of the car."

With this object in view the two cranks *a a*, figs 1 and 5, are made so that the centre of their journals will not be in a plane which passes through the center of the shaft, but "are arranged so as to form acute angles upon the same side of the shaft with a medial plane through the axis of the shaft," as shown in fig. 1 and in fig. 5, which is a perspective view



of the cranks. *B* is the hand-lever by which the cranks are operated. The fulcrum *E* of this lever is not fixed but is vertically movable, the blocks *F F* being arranged to slide vertically in the guides *i i*, which are supported by the A-shaped frame *H H*. Figs. 2 and 3 are respectively transverse and horizontal sections of the block *F* and guides *i i* The shaft *A* has a gear wheel *D*, and the arch *J* has a pinion *I* of the usual construction.

It is not easy to see how this invention "overcomes largely the loss of power incident, through indirect action of the levers and unnecessary friction, to the common construction of car," as he claims, unless the common construction of cars is a very stupid one.

An Early Lake Steamer.

"The new and fast-sail steam-packet 'Phœnix,' plying between Buffalo and Chicago," was the legend that delighted the traveler upon the lakes 37 years ago. The "Phœnix" was built at Cleveland in 1845 by Capt. G. W. Jones, who was her commender during her first season. The boat was 144 ft. in length, 26 ft. beam, 11 ft. in depth of hold, and her cabin extended the full length of the main deck; instead of the upper deck the forward portion was devoted to the steerage or second-class passengers, and all abaft of the engines to first-class or cabin passengers. The conventional Phœnix was distributed in all parts of the boat, rising in sheet-iron from the flames on top of the smokestack and exhaust-pipes; also was brilliantly figured upon her ensign and private signal. One of her flags also pictured the old "Phœnix" hand-engine that at that time protected the property of Cleveland. The craft was of light draft and furnished with two wheels, very sharp lines, and was the speediest as well as largest of the day. Capt. B. G. Sweet commanded her for three years, and at the time she was burned abreast of Sheboygan, on Lake Michigan, a large number lost their lives in the disaster.

Vicissitudes.

We learn with a good deal of regret that one of our favorite roads will adopt several hundred miles of barbed wire fence along its line this summer. The grief and humiliation of being fired from a moving train for non-payment of dues is greatly aggravated by fetching up with a dull thud on the top wire of a fence that has sharp protuberances on it.—*Laramie Boomerang.*

A good story is abroad about Conductor Dudley, of the C., B. & Q. road. It is to the effect that last week while butter was quoted very high at Galesburg he bought a small tin pail full at one of the way stations where it was cheap, thinking to make an honest quarter by the operation. It was at night time when he bought the butter, and he deposited the bucket on one side of him and the lantern on the other while making the change to pay the boy who brought it to the depot. When it came time to pull out he unthinkingly picked up the bucket of butter, and swinging it over his head, shouted all aboard and jumped on the train, leaving his lantern setting peacefully on the platform. As the train got under headway he mechanically hung the bucket over his arm, procured his punch and went through the cars taking up tickets. The laugh that began with the first man he accosted gradually swelled into a chorus as he went from one to another, but Dudley passed on blissfully unconscious of the cause of the merriment, until some one told him his lamp was out. Then he came to himself with a sort of ghastly thud that sounded like a basin of water thrown out of an upstairs window, and dark melancholy marked him for its own.—*Quincy (Ill.) Herald.*

A lately initiated locomotive fireman says, knowledge may be power, but he discovers just the same that it takes a good deal of coal to keep up steam.—*Rome Sentinel.*

Between the young man scented with cigarettes and the young woman scented with musk and patchouly, the railway passenger gets a good deal for his six cents these days. *Philadelphia News.*

The new depot at Hannibal cost $150,000, and was opened with a ball and banquet. If you get round to Hannibal within two years, you may be able to get some relics of that banquet at the railroad restaurant.—*Boston Post.*

Rails in Tunnels.

Continental railway engineers have for some time past noticed that the destruction of rails in tunnels is exceedingly rapid, the rails showing, besides the usual marks of wear, longitudinal cracks, which gradually increase in size, until eventually the table of the rail is completely separated from the shank, sometimes for considerable lengths. It has also been noticed that the best rails do not escape this kind of deterioration, which is attributed to the sand used for insuring the adhesion of the wheels of the engines to the rails. It is impossible to dispense with the use of the sand, since the rails are covered with a deposit of fatty nature, due to the oil used in lubrication, and to the water resulting from the exhaust steam, which is speedily condensed in the confined space of a tunnel. The grains of sand become gradually incrusted in the slightest superficial scratches of the table of the rails, and at last act as wedges under the repeated pressure of the wheels. It is naturally of great importance to introduce a remedy for this evil, and it is stated that in the Hauenstein tunnel, Switzerland, a jet of hot water from the locomotive was employed to free the surface of the rail from the fatty deposit, and perfect adhesion of the wheels was thus insured.—*Exchange.*

Continuous Brakes in the British Parliament.

Mr. Clement E. Stretton in a letter to the *English Mechanic* describes as follows the present status of the "Continuous Brakes Bill," which was presented to the House of Lords by the Right Hon. Earl De-la-Warr, on Feb. 24, and read a first time, and on March 20 was read a second time, without decision. Of the action of the House Mr. Stretton says:

"The object of the measure was to compel the companies to fit their trains with brakes which fulfil the Board of Trade conditions; hence, it followed that all persons who have spent large sums of money in trying to push brakes which are inefficient, tried to the utmost to prevent a bill becoming law which would require really good brakes to be used. A combination among the railway representatives in the House of Lords was formed, and two modes of attack decided upon. 1. To move the previous question and thus quietly smother the subject. 2. To eliminate in committee the second or automatic section, by which the bill would be rendered perfectly useless.

"On Monday, May 22, Lord De-la-Warr moved that the House go into committee on the bill, upon which Lord Colville (Chairman of the Great Northern) moved the previous question.

"Lord Sudeley, on behalf of the Board of Trade, expressed a hope that the House would go into committee with the view to having it considered by a select committee; and after quoting the data given in the last return, he remarked:

"'The Board of Trade had up to the present time been in hopes that the force of public opinion, and the moral pressure which they were able to bring to bear upon the companies, with these returns before them, would have induced them voluntarily to take up and deal thoroughly with this important question. Such a course was in every way far more desirable than to compel them by legislation to do so; but after the experience of the last five or six years, it was difficult to maintain that anything short of legislative enactments would induce the companies thoroughly to grapple with it. In these circumstances, and while the Board of Trade would not, perhaps, have initiated a measure of the kind which was now before the House, they could not help thinking that the time had arrived, in the interests of the taveling public, when some pressure should be put on the companies.'

"Lord De-la-Warr said it was rather an unusual course to move the previous question on a motion to go into committee on a bill which had been read a second time without opposition. The only inference he could deduce was that the noble lord (Colville) did not wish that the bill should be considered on its merits, as it might be in committee.

"The previous question was carried without a division, and the matter is therefore delayed for the present. The *first* mode of attack having succeeded, the *second* was not required, but it will nevertheless be advantageous to consider the subject. Had the measure reached the committee stage, an amendment would have been moved to throw out the automatic clause on the ground that automatic action is wrong because it is not used in other appliances on railways. This latter assertion has been so often made that some persons may begin to think it true; it will therefore be well to point out that an automatic brake which will not allow a train to proceed unless it is in safe condition, simply carries out the principle applied to all railway signals and the block system. When a signal wire breaks, the signal flies automatically to danger, and stops the traffic.

"In working the block system, it is a rule that 'in the event of any failure of the instruments or bells, no train must be allowed to pass a signal-box on that section of the line where the failure exists, without having been previously brought to a stand, and the driver and guard advised of the circumstance.' Years ago all railway signals in their normal position were off, and only put on to protect or stop a train when required; but at the present time every signal stands at danger, and is only taken off for a train to pass when necessary. Now this is exactly the principle which applies to continuous brakes. A non-automatic brake is always off, and requires to be put on, and there is always the fear that this cannot be done when necessary.

"An automatic brake may be considered as always on, and requires to be taken off, therefore it is certain to act when wanted; but like the signals and block system, when it fails it will cause slight delay to the traffic; but this is indeed a small matter compared with the very great safety obtained."

Cost of Building a Railroad.

The Atlanta (Ga.) *Constitution* thus reports an interview with Major J. W. McCracken, who has charge of the building of the East Tennessee, Virginia & Georgia Company's new line from Macon to Rome:

'To start with, how long is your road?'

"It is 161 miles long with 12 miles of side-tracks—total 173 miles."

"How much did it cost to survey the line and locate it?"

"Colonel Sample and I rode over the line from May 30 to

June 4. The engineer corps were filled up by July 26. We paid out to these corps just $65,000 before we had decided on our exact route."

"The route once decided on you had to buy the right of way. How much did that cost?"

"Just $85,000. Of course much of it was given to us, but we paid to agents and for right of way $85,000."

"You had to have equipments, tents and tools, and wagons and machinery to work with—cost of this?"

"About $175,000. You see we bought the very best of machines for laying track, for building trestles, grading, etc. These are very costly. Our equipment was first-class in every respect. And much of what we have can be re-sold."

"Then having secured the right of way you had to go to grading. How much did that cost!"

"The grading alone cost $850,000. But we have already paid out to contractors for grading, bridges, etc., $1,500,000. The Rome extension is not finished and we will pay out nearly enough to make the total paid to contractors go up to $2,000,000."

"Time for breath! Thank you. Track once graded the next is cross-ties—cost of these?"

"They cost us laid in the track $460,000. There are 2,640 ties to the mile or 456,720 ties between Rome and Macon. This represents the number of steps a tramp must take when he walks over our roads."

"After the cross-ties comes the rails. What did these cost?"

"The rails weigh 56 lbs. to the yard. They cost in New York, $858,350. To this must be added freight from Perth Amboy to Macon, Atlanta and Rome. Say in all $900,000."

"After the rails comes the depots. What about these?"

"We have paid out $216,000 for the ground for depots, yards, etc., the most of it in Atlanta and Macon. We have contracted for 20 depots at a cost of $75,000. They are to be tasty modern wooden depots. Of course our city depots will cost much more. We have not yet arranged definitely for these."

"How about the equipment?"

"We shall use the splendid equipment of the rest of our line for this division, but to bring it up to the standard we have ordered for its quota to the general equipment 400 new coal cars, 600 box cars and 20 passenger cars, at a cost of $750,000, and 26 new engines at a cost of over $300,000."

That closes it up. Let's recapitulate; For tents, machinery, tools, etc., $175,000; for location and right of way, $150,000; for grading, bridges and trestles, $2,000,000; for cross-ties and laying them, $460,000; the rails, $900,000, depot ground and depots, $291,000, and eqipment, besides what the rest of the line contributes, $1,050,000, making a total of $4,926,000 for 173 miles. And that is what it costs to build a first-class road, as figured by one who paid out the money.

"Where was the most of this paid out?"

"In Georgia. The $2,000,000 for contractors was all paid out in Atlanta, and most of it spent here. The $150,000 for survey and right of way was all paid out in Georgia. The $460,000 in cross-ties was paid along the Macon & Brunswick road for the Macon Division, and along the track of the grade for the Rome Division. The $291,000 for the depots and grounds, and most of the $175,000 for getting ready was spent here. Our bills for ten months with one house in Atlanta were over $75,000. We have spent about $3,000,000 for labor and material that circulated in Georgia."

Wrought Iron Driving Wheels.

Some of the English shops which have made a decided specialty of wrought-iron wheels for locomotives, have reduced the process of making them to a very perfect system. They employ for the first forming of the parts of the wheel the usual drop-forging method of working, so that when the welding required in closing up the wheel as a whole is reached, it is found to be the very least possible in amount, and of the plainest kind.

The arms are formed in dies, which give to the inner end of each piece a wedge-shaped outline, of such a taper that these several pieces, when laid snugly together, shall form a compact mass around the eye, or central hole, which is to be left for the axle. The outer end of each arm is upset so that it may be readily welded, in suitable hammer dies, to a flat bar or block, long enough on each side of the arm or wheel-spoke to reach to the corresponding piece on the next arm. Each end of this block, thus put in a T-shape to form the rim of the wheel, is scarfed down so that in finishing the rim a V-piece can be welded in on each side, thus joining the T-ends of the arms, and making a complete circle.

When the pieces have been made ready they are laid on a suitable bench-block and closely drawn together with a band around the outside of the rim. Thus, in a rough way, the whole outline of the wheel is complete before any of the parts are actually welded to each other. A thick circular plate is then laid on the inner ends of the arms, to serve as the boss on the face of the wheel, and a heat is taken on the whole central mass. A few blows under a suitable hammer then weld the whole hub, one piece to another, and, if the shape of the wheel requires it, a second plate or boss is also welded on the other side of the hub. A heat is then taken on the parts of the rim between each two arms, and the V-pieces referred to are welded in solid, one at a time.

If the wheel requires an eye or boss for a crank-pin, as nearly all these locomotive wheels do, then the arms which must pass through this boss are formed with thickened places on them, so as to fill up the outline of the crank-boss solid, and the facing plate or piece which is to form the front of the hub, is made of an oval shape, so that it may cover the whole area of the central boss and the crank-pin eye besides.

The wedge-shape enlargement of each arm is carefully worked up to the outline needed for strength and neatness, at the inner end where the arms touch each other, so that in the welding of the central body of the wheel the fillet outline is left so true and perfect as to need little or no cold-finishing afterward. The joining of each arm and its own piece of the rim, being made in a hammer die, is quite perfect after the few blows of the hammer have been given, and it usually receives no further attention except the painting. Care is obviously needed in heating and in welding the center of the wheel, and in keeping the rim true to the circle, so that the turning off of the outside shall leave a uniform thickness at the rim. In some cases the inside of the rim betweed the spokes has been tool-finished on a slotting machine, cutting to a vertical curved outline, thus leaving the rim thicker in the middle of its width than at the edges, but the expense of this kind of finishing is rarely incurred.

Comparisons are sometimes made between the skillfulness of English workmen who do this class of work and their American fellow-blacksmiths, somewhat to the disadvantage of the latter, but there can be no reasonable doubt that when a real call exists for such wrought-iron wheels in this part of the world, there will be plenty of places where they can be had. It now looks as though the first substitute for the American cast-iron driving wheel would be a solid steel casting, which shall be made ready for the tire with less work than is now needed, and which shall be even lighter than the solid wrought wheel itself.—*Exchange.*

OLD AND NEW ROADS.

Ashland.—This company has been organized to build a branch from the Chicago, St. Paul, Minneapolis & Omaha's new Bayfield line to the village of Ashland. It will be about 10 miles long.

Atlantic & North Carolina.—At the annual meeting in Morehead City, N. C., last week, there was some discussion over preliminary matters, chiefly as to the right to vote on certain stock. It was shown that Mr. Best holds a majority of the private stock, and he was finally allowed to vote on all of it. This will probably put an end of the movement to break the lease of the road to the Midland North Carolina Company.

Atlantic & Pacific.—We are informed that the announcement of the extension of this road to Williams, Arizona, was premature, no track having yet been laid west of the Cañon Diabolo. It is expected that track-laying will begin this week.

On the Central Division, track is now laid to Claremore in the Indian Territory, 26 miles west from Vinita, which has been the terminus for a number of years. This division is operated for the present by the St. Louis & San Francisco Company.

Boston, Hoosac Tunnel & Western.—The branch or extension of this road from Mechanicsville northwest to Saratoga Springs, 16 miles, is completed, and regular trains will shortly be put on. Through cars will be run between Boston and Saratoga in connection with the Fitchburg road.

No work is now being done on the main line west of Schnectady.

Boston & Maine and the Eastern.—The Boston *Herald* of July 1 says: "The proposition of the Boston & Maine directors is for a lease of the Eastern road to the Boston & Maine for a period of 50 years, on the following conditions: After all the running and incidental expenses of both roads, including lease of branch lines, etc., are paid from their joint income, and interest on bonded debt, taxes, etc., are also paid, a dividend of 8 per cent. is to be paid the stockholders of the Boston & Maine road. Then there is to be paid, annually, the sum of $100,000 for the sinking fund of the Eastern road, created by law, which sum is to be paid annually until the debt it was created to cancel is wiped out. This amount is about 2 per cent. of the stock of the Eastern road, and is, it is claimed, practically a dividend to the stockholders of that road. When these things have been provided for, what remained to be divided equally between the two corporations, and what is thus realized to the Eastern will belong to its stockholders. According to calculations made by the officers of the Boston & Maine road, there will be a saving over the present system of running the roads separately of about $300,000 under one management, in reduction of expenses of operation, and at least an equal amount annually in a uniform tariff and no competition between the roads at certain competing points, which would of itself give an increase of income sufficient to insure to the Eastern stockholders a sum equal to 6 per cent. on their stock. This proposition of the Boston & Maine has been under consideration by the directors of the Eastern road, and in response a counter proposition to the directors of the Boston & Maine road was drawn up and agreed to at a meeting of the Eastern directors held at noon yesterday. This proposition is in writing, and was yesterday handed in to the President of the Boston & Maine road, and will be by him submitted to his directors.

"It would perhaps be premature to state just what the proposition of the Eastern directors is. It will present important modifications of the terms proposed by the Boston & Maine people, but is believed to outline a basis upon which negotiations can be carried to the desired end. It may be well to state, however, what is known to be the views of the Eastern people in regard to the merits of the property they represent in certain respects. They hold that inasmuch as their road owns the majority of the stock of the Maine Central railroad, which embraces nearly the entire railway system of Maine, and which cost the Eastern corporation in principal and interest about $3,000,000, the lease of their road to the Boston & Maine would give the latter corporation a controlling interest in all the roads east of Portland, that would be of great value to that corporation, which can therefore well afford in view of such a lease to give more liberal terms than those offered."

Broadway Connecting Undergrouud.—A suit has been begun by Origen Vanderburg to set aside the recent election of directors, and to have himself and six other persons declared directors of the company, on the ground that certain stock voted for the other party was illegal and void.

Buffalo, Pittsburgh & Western.—The Commissioners appointed by the New York Supreme Court to settle the long-existing crossing controversy at Salamanca, between the New York, Pennsylvania & Ohio and this company have arrived at a conclusion by abandoning the projected line of the Buffalo, Pittsburgh & Western across the New York, Pennsylvania & Ohio depot grounds, and adopting a new line, for which the attorney for the Buffalo, Pittsburgh & Western asked confirmation before Judge Barker, at Buffalo June 30. The confirmation was resisted by the New York, Pennsylvania & Ohio on the ground that the commission adopted a route which they had no authority to take. The Judge reserved his decision.

Chesapeake, Ohio & Southwestern.—The bridge over the Hatchie River and all the grading on the gap north of Covington, Tenn., are completed, and the track-laying is to be finished early in the present month. This will complete the Chesapeake & Ohio line to Memphis.

Chicago & Atlantic.—A letter from an officer of this road says: "The track is now laid 15 miles out of Lima toward Kenton, and 10 miles out of Marion toward Kenton, and the work is progressing at the rate of 1½ miles a day at each end.

"At Marion there are two miles of box cars standing on the side tracks, and the shops are turning them out faster than the company can take care of them. All the flat cars are employed in carrying rails from Pittsburgh. Forty locomotives are ordered from the Brooks Locomotive Works, to be turned out by Sept. 1, and everything is being done to rush the road on to completion."

Chicago, Milwaukee & St. Paul.—A Milwaukee dispatch of June 29 says: "Advices were received here to-day announcing that a meeting of the Chicago, Milwaukee & St. Paul directors had been held, and that the issue of the new stock had been decided on. The plan will be to allow each stockholder a *pro rata* share of one-half the new stock, and whatever remains the company will have the right to dispose of as it sees fit. The other half will be paid for in surplus earnings from private sources.

"It is learned that the Chicago, Milwaukee & St. Paul has dispatched a party of surveyors to a point near Red Wing, Minn., and has issued instructions to them to run a line parallel with that of the Cannon Valley road, which is being built by Mr. A. B. Stickney and other Southern Minnesota capitalists.

"The St. Paul company abandoned the idea of a road from Hastings to Cannon Falls, and will now survey a line from Red Wing to the latter point."

Chicago, Texas & Mexican Central.—This road finally passed into possession of the Gulf, Colorado & Santa Fe Company on July 1. The price paid for it is not made public.

Chicago & Western Indiana.—This company is building a large new freight house on Fourth avenue and Taylor street, in Chicago, for the use of the Louisville, New Albany & Chicago road.

Cincinnati, Van Wert & Michigan.—This road has been extended from the late terminus at Latty, O., northward to Paulding, the county seat of Paulding County, a distance of three miles. The road is now 32 miles long, from Paulding to Shane's Crossing.

Cincinnati, Wabash & Michigan.—On July 1 regular trains began to run through to the new terminus at Niles, Mich., 28 miles northward from Elkhart, Ind., and 149 miles from the southern terminus at Anderson.

Delaware & Hudson Canal Co.—This company has completed an extension of its Glens Falls Branch from Glens Falls, N.Y., northward nine miles to Caldwell, at the head of Lake George. This extension enables passengers to reach Lake George without the stage ride hitherto necessary.

Denver & New Orleans.—A branch of this road has been completed and opened for traffic from Franceville Junction, Col., to Franceville. It is four miles long.

Eastern.—This company makes the following statement of gross earnings for May and the eight months of the fiscal year from Oct. 1 to May 31:

	May.	Eight months.
1882	$273,361	$2,047,879
1881	251,465	1,861,613
Increase	$21,896	$186,266
Per cent	8.2	10.0

The increase this year is very good, for a road with only a very slight addition to mileage, and no new country on its line.

East Tennessee, Virginia & Georgia.—Track is now all laid on the extension of the Macon & Brunswick line, from Macon, Ga., to Atlanta, and a train ran through July 3. The work of finishing up is nearly done, and regular trains will be put on the road about Aug. 1. The distance from Macon to Atlanta is 87½ miles, or 15½ miles less than by the Central Railroad of Georgia. The road has been built in a substantial manner, laid with 56-lbs. steel rails and will be provided with subtantial station and shop buildings.

Work is progressing well on the line from Atlanta to Rome, 73¼ miles, and the contractors now expect to have it done by Sept. 15.

The whole line from Macon to Rome will be 161 miles long, with about 12 miles of sidings. The whole line, including all expenses, right of way, buildings and an equipment of 26 engines, 20 passenger-train cars and 1,000 freight cars, will cost (estimating the work yet unfinished), about $4,926,000 or $30,596 per mile. This includes some expensive real estate and station buildings in Atlanta.

With the old Macon & Brunswick road, the new line will be 347 miles long, from Brunswick to Rome, connecting at the last named point with the other lines of the East Tennessee system. The line runs through the cotton country of Middle Georgia, and the lumber region along the coast.

East Tennessee & Western North Carolina.—This road is now completed to the great iron mines at Cranberry, N. C., 19 miles eastward from the late terminus at Hampton, Tenn., and 34 miles from the junction with the East Tennessee, Virginia & Georgia road at Johnson.

Erie & Pittsburgh.—The bonds maturing July 1 will be paid on and after that date on presentation to the Union Trust Company in New York. These bonds are the 7 per cent. first-mortgage bond, and the amount outstanding by the last report was $249,200.

Escuintla—Guatemala.—This road is to run from the town of Escuintla to the city of Guatemala, the capital of Guatemala, in Central America. It will be 38½ miles long, and the parties holding the concession have also the right to acquire the existing line of 28½ miles from Escuintla to the port of San Jose on the Pacific Coast. The guage of the existing road is one metre, but the concession gives the option of making the new road either one metre or 3 ft., and of changing the old road to correspond. It is expected that a considerable traffic can be secured in coffee and other products of the country, which are exported from San Jose, and also in goods imported through that port. The concession gives the right to purchase the highway road, and to charge rates of toll which would practically prohibit competition by the wagons, which now carry the freight.

On the road from Escuintla to Guatemala some heavy grades will be required, the line rising 3,896 ft. in 35½ miles from Escuintla to the summit, and falling 141 ft. in three miles from the summit to Guatemala. The summit is 5,019 ft. above the sea. On the old road from San Jose to Escuintla there is a rise of 1,123 ft. in 28½ miles. The present location provides for one grade of 225 ft. to the mile. The estimated cost of the new road is $1,500,000, or $38,961 per mile.

Grand Rapids & Indiana.—Track is now all laid on the extension from Petoskey, Mich., to Mackinaw City on the Straits of Mackinaw. Regular trains will run through to Mackinaw this week. The extension is 35 miles long, and has been built by a separate organization known as the Grand Rapids, Indiana & Mackinaw Company, which is entirely owned by this company.

The company has also recently completed two branches, one from Missaukee Junction, Mich., eastward to Round Lake, six miles; the other from Milton Junction, near Reed City, westward to Luther, 12 miles. They are built chiefly or logging purposes.

Grand Trunk.—This company now runs dining cars on its through express trains east and west between Sarnia and Stratford, giving passengers sufficient time for meals.

Grand Trunk and the Great Western.—At the meeting held in London, June 29, by the shareholders of the Grand Trunk Railway Company the agreement with the Great Western Railway Company, drawn up on May 25, was almost unanimously approved. There were only eight dissenting votes.

At the meeting of the Great Western shareholders there was a warm discussion. The amalgamation resolution was overwhelmingly carried by a show of hands, only seven votes being cast against it. The minority demanded a poll, the result of which showed that 1,072 proprietors, commanding 83,492 votes, favored amalgamation, and 8 proprietors, commanding 1,100 votes, opposed it. The amalgamation resolution was declared carried. Some of the minority stockholders filed a protest and threaten legal proceedings.

Gulf, Colorado & Santa Fe.—This company took possession of the Chicago, Texas & Mexican Central road July 1. The road is 52 miles long, from Cleburne, Texas, to Dallas, and is reported to be in poor condition. It forms a branch of this road to Dallas, giving it a line from Galveston to Dallas, 369 miles long.

Hudson Tunnel Railroad.—Work is progressing well on the tunnel under the Hudson River from the New Jersey side. About 30 feet a week is now the rate of progress. On the New York side the masonry of the third 10-ft. section has been completed, and the roof plates in the heading of the fourth section have been advanced seven feet.

Illinois Central.—The following circular was issued June 26: "The Illinois Central Railroad Company has leased the Chicago, St. Louis & New Orleans Railroad, extending from East Cairo, Ky., to New Orleans, La., with a branch from near Durant, Miss., to Kosciusko, Miss., and will operate the same as a leased line from and after July 1, 1882.

"Connecting lines are respectfully requested to continue making their reports to the same officers at New Orleans, to whom they have heretofore reported, and who are hereby continued in their respective positions as officers of the leased line. Settlements for balances due by and to the Chicago, St. Louis & New Orleans Railroad Company will be made, as heretofore, through the New Orleans office."

Kansas, Bloomington & Northwestern.—This company has been organized at Harlan, Smith County, Kan., the capital stock to be $3,000,000. The road is to commence at the town of Fall River, in Greenwood County, Kan., running thence to Eureka, Peabody, McPherson, Ellsworth, Osborne, Harlan, and Smith Centre, and thence to Bloomington, Neb., a total distance of 300 miles.

Lake Erie, Wooster & Muskingum Valley.—This company has been organized and is making arrangements to begin work at once on the section of the road from Wooster, O., northward to Burbank, on the New York, Pennsylvania and Ohio road. The distance is 15 miles.

Live Oak, Tampa & Charlotte Harbor.—The grading of this road is nearly all done from Live Oak, Fla., southward to Rowland's Bluff on the Suwannee River. Tracklaying is in progress and the rails are down for six miles from Live Oak. The road is the southern extension of the Savannah, Florida & Western.

Manhattan Elevated.—Certain stockholders of the Metropolitan Elevated Company have applied to the Attorney General of New York to have the directors of that company removed, on the ground that they have abused their trust and sacrificed the interests of the stockholders. The Attorney General has set July 12 for a hearing, and will afterwards decide whether to begin proceedings or not.

Marietta & Cincinnati.—The trouble with the Cincinnati & Baltimore stockholders, who have so far refused to come into the plan of reorganization, has not yet been settled, although negotiations are in progress.

In the foreclosure suits pending, the Court on July 1 consented that the application for the entry of the decree should be made, if desired, during vacation time, so as to secure a foreclosure sale at the earliest possible day.

Midland North Carolina.—Track on this road is now laid to Smithfield, N. C., 22 miles westward from Goldsboro, and a regular train will soon be put on. To Smithfield the line is parallel and close to the North Carolina road, but from that point the Midland will run nearly due west, while the North Carolina road turns to the northwest.

Milwaukee & Lake Winnebago.—Much of the grading on this road, the new branch of the Wisconsin Central, from Schleisingerville north to Neenah, has been done. The company, June 28, filed with the Secretary of State, at Madison, a mortgage for $1,950,000, covering 65 miles of the road from Schleisingerville to Neenah. The mortgage is to secure gold bonds of two series, the first series aggregating $1,430,000, to bear 6 per cent. interest, and the second amounting to $520,000, bearing 5 per cent. interest.

Morgans's Louisiana & Texas.—A branch of this road has recently been completed from Cades, La., 132 miles from New Orleans, northeast to St. Martinsville. It is seven miles long.

New York Central & Hudson River.—The partial strike of the freight brakemen on this road lasted only a day or two. The company has given the men an increase of pay to $1.85 per day.

New York Freight Handlers' Strike.—The strike of the freight handlers in New York and Jersey City for an increase in pay from 17 to 20 cents an hour still continues, with no signs of giving way on either side. Since last week the companies have made some advance in securing men, and have been able to relieve the pressure at their stations and docks somewhat. They have been aided in this by the fact that July 3 was practically a holiday in New York, giving them three clear days in which to work off accumulations, and also by the fact that the rush to ship west-bound freight before the new and higher rates took effect, is over. The new forces, however, are largely made up of immigrants just arrived, who are new to the work, while many of them are ignorant of the language and require interpreters to transmit the orders given, which makes delay and trouble.

Of all the companies the Pennsylvania seems to have the largest and most efficient force now at work, and the New York Central the smallest. As usual, there are reports that each party is about to give way, but they are from interested sources and hardly worthy of credit.

The strikers have generally preserved excellent order, and there has been no attempt at violence. Some Italians were assaulted in Jersey City, but the disturbance was clearly traced to roughs who were not strikers, and who were attempting to make a riot to further their own ends. At present it is not easy to say what the end of the strike will be.

New York, Lake Erie & Western.—This company has just completed a branch line 1½ miles long, from True's Siding, on the Rochester Division, east to Lakeville, at the foot of Conesus Lake. It will be used chiefly for the excursion and summer travel to the lake.

The company is giving a good deal of attention this year to the excursion and pleasure business, and is taking especial pains to attract travel to points on its lines.

New York & Long Branch.—On the morning of June 29 a New Jersey Central passenger train running over the New York & Long Branch road ran off the track on the pile bridge over a broad, shallow arm of the Shrewsbury River at Little Silver, N. J. The engine, baggage car and drawing-room car ran across the bridge on the ties, but the smoking car and four following passenger cars went off the bridge and fell upon the muddy bottom of the river in water about four feet deep. The cars were badly wrecked, one passenger was killed at once, five others so hurt that they have since died, and 47 less severely injured. The evidence taken at the coroner's inquest indicated that the accident was caused by the spreading of the rails at a point at the head of the bridge, where the trackmen had been putting in a switch the day before and had left the rails only half spiked, expecting to finish their work next day. The bridge had no guard rails. The verdict of the jury was that the deceased "came to their death from the accident, which was caused by spreading of rails on the Parker's Creek bridge; and that the New York & Long Branch Railroad Company is guilty of gross and culpable negligence."

The New York & Long Branch road, which was formerly worked by the New Jersey Central, is now under a separate management, both the Pennsylvania and the New Jersey Central running trains over the road. A Pennsylvania express train had passed over the bridge only a few minutes before, and it is possible that it had so loosened the insecurely fastened rail that it was ready to give way when the next train struck it.

The wrecked train had a large number of passengers on board; it was an express, stopping only once between Long Branch and Jersey City, and was a favorite train with New York business men who came in each morning. Many well-known men were on board, including Gen. Grant, who was taken out unhurt and assisted in directing the removal of the injured; Mr. George R. Blanchard of the Erie, and W. R. Garrison, President of the Metropolitan Elevated, who was fatally hurt.

The accident will probably be an expensive one to the company, as large claims for personal damages will undoubtedly be made. Many of the injured are men who have means and resolution to carry their claims through the courts, should the company resist their payment.

The evidence showed that the train was running about 35 miles an hour when it passed Little Silver station, a few hundred feet from the bridge, and that it did not slow up perceptibly for the bridge.

New York, Susquehanna & Western.—This company's bridge over the Delaware, near the Water Gap, is near finished. It is an iron bridge of four spans.

Work progresses somewhat slowly on the extension from Ogdensburg, N. J., to the Delaware, heavy grading being required at several points. Track-laying has been begun from the Lehigh & Hudson River crossing towards Sparta.

Ohio Southern.—This company has completed and opened for business a branch from Jackson, O., the eastern terminus of the road, northeast to Wellston, 10 miles. It is built to reach coal mines on the line.

Pennsylvania.—The Sewickley Branch has been completed from the Southwest Pennsylvania Branch at Youngwood, Pa., to Granger, seven miles. It is to be extended to the main line at Latrobe. This branch has two coal spurs, one from Boyer Run to Hecla, 1.7 miles, and one up Brinker Run, one mile. It reaches a coke district.

This company has just issued an order to baggage and station agents, which recites that beginning July 1, 1882, all baggage, consisting of trunks, chests, valises, packages, etc., unclaimed for more than 48 hours will be charged at the rate of 10 cents per day until the charge reaches one dollar. This latter sum will be charged for all baggage unclaimed for from 10 to 30 days.

Philadelphia & Atlantic City.—An application is to be made shortly on behalf of the Camden & Atlantic Company, which now owns this road, to have the road taken out of the hands of the trustees, and the Receiver discharged.

Philadelphia & Reading.—No statement has been made public of the amount of the new consolidated taken when the subscription was closed on Saturday last. It is reported that only a small part of the $13,500,000 offered was taken.

The company gave notice July 1 of its intention to pay, on and after July 5, at the London office of the company, the first-mortgage bonds maturing July 1. The company is now paying the coupons of the general mortgage bonds due July 1, being the first time that interest has been paid in cash and at maturity since 1877. No payments on account of scrip issued for coupons of the general mortgage debenture, Perkiomen Railroad, and other interest have yet been made. The amount of first-mortgage bonds maturing is $134,000, and the amount of interest on the general-mortgage loan due is $592,000.

Pittsburgh, Bradford & Buffalo.—This road has been completed to Marienville, in Forest County, Pa., 14 miles northeast of the old terminus at Tylersburg, and 51 miles from Foxburg, the Western terminus.

Quebec, Montreal, Ottawa & Occidental.—A dispatch from Quebec, June 30, in relation to the transfer of the Eastern Division of this road (Quebec to Montreal), says: "A meeting of the directors of the North Shore Railroad syndicate was held this evening. The $500,000 required to secure the transfer of the road from the government will be paid to the Provincial Treasurer to-night, when the transfer of the road will be signed by Mr. Chapleau and the Lieutenant-Governor, and from and after 12 o'clock the North Shore Railroad becomes the property of the company. The question of purchasing the Richelieu Company's boats did not come up at the meeting, as expected."

Reading & Chesapeake.—At a recent meeting of the stockholders it was reported that the location of the line had been finished from New Holland, Pa., to Perryville, Md., about 80 miles. Work will be begun on the line and also on the branch to Lancaster, as soon as the contracts can be let.

Richmond & Danville.—At a meeting held in Richmond, July 3, the stockholders passed a formal vote accepting the act of the Virginia Legislature authorizing the company to increase its capital stock.

The stockholders also voted to appove of the purchase of one-half of the increased capital stock of the Richmond & West Point Terminal Railway & Warehouse Company, in order to preserve the control of that company; also to authorize the issue of $1,000,000 new stock to be used in paying for one-half of the new Terminal stock. The other half is to be paid for in money.

St. Johnsbury & Lake Champlain.—It is reported that an agreement has been concluded for the lease of this road to the Connecticut & Passumpsic Rivers Company.

St. Johns & Halifax.—The Palatka (Fla.) *Herald* says: "Mr. U. J. White, who is building a railroad from Railstown three miles above here on the St. Johns River to the Halifax, on the Atlantic, has the most systematic way of constructing we know of. He is President, Vice-President, Secretary, Paymaster, Treasurer and everything else, where brains is required. He started this road eight months ago with a few mule teams—laid one mile of track, and commenced hauling saw logs and cord wood; he now has nine miles of the road completed and a new locomotive running every day hauling quantities of timber. We are informed that Mr. White has done all this with what he made out of the timber."

St. Louis, Des Moines & Northern.—Track on this road is now laid to Boone, Ia., 16 miles northward from the late terminus, and 39 miles from Des Moines. The road crosses the Chicago & Northwestern tracks just outside of Boone, on a bridge.

St. Louis, Iron Mountain & Southern.—Work is progressing rapidly on the Arkansas Branch. Tracklaying has been begun on the southern end, from Forrest City, Ark., the crossing of the Memphis & Little Rock road.

Sauk Centre Northern.—Work is soon to be begun on this road, contracts for the grading having been let. It is to be completed this year from Sauk Centre, Minn., on the St. Paul, Minneapolis & Manitoba road, northward to Long Prairie and Eagle Creek, about 25 miles; a further extension will be built next year. The road is controlled by the Manitoba Company.

South Chicago.—The Chicago *Tribune* says: "Now that the Illinois Central Railroad have announced their intention to abandon their South Chicago Branch project, because of obstacles in the shape of grasping property-owners along the proposed right of way, a new organization has made its appearance and given a not entirely unexpected turn to the case. Upon the authority of one of the parties interested, it is stated that a new and independent company is in process of organization for the purpose of securing the right of way abandoned by the Illinois Central. The company intend to lay their tracks during the present season, and expect to have the road in running order between South Park and South Chicago within the next six months."

Texas & Pacific.—The Boston *Advertiser* of July 2 says: "The interest on the land-grant income bonds of the Texas & Pacific Railway was not paid yesterday, for the reason that it was thought for the best interest of the bondholders that no scrip should be issued, and the earnings of the division were not sufficient to pay it in cash. These are 7 per cent registered bonds, due in 1915, secured by a first mortgage on about 4,000,000 acres of land lying along the Rio Grande Division, and also a third mortgage on the road and equipments east of Fort Worth. By the terms of the mortgage recited in the bonds themselves, the company can, at its option, in case the earnings in any one year are not sufficient to pay the interest, issue in payment thereof scrip which is convertible into land or stock. The lands belonging to the state of Texas have been sold to emigrants, thereby enhancing the value of the land owned by the railroad, and the scrip, if issued now, would not be turned in, but held, as some formerly issued now is, for conversion. Thus, what a year ago would have been a benefit to the bondholder would not only add an additional encumbrance in the shape of liens on the land, so that the company, having the option, preferred to issue none this year."

Titusville & Sheffield.—This company has been organized to build a railroad from Titusville, Pa., eastward to Sheffield on the Philadelphia & Erie, about 30 miles.

Toledo Belt.—This company has filed articles of incorporation to build a belt or transfer railroad around the city of Toledo, O. The capital stock is fixed at $300,000.

Tucson & Gulf of California.—Chief Engineer S. R. de Long has completed the location of this road from Tucson, Arizona, through Mexico to Port Lobos on the Gulf of California. The distance is 200 miles, and in no place is the grade over 70 feet to the mile, the average being but 30. There are two rivers on the line, the Santa Cruz and Altar.

Vicksburg, Shreveport & Pacific.—About 20 miles of grading are now finished between Shreveport, La., and Arcadia, and some 12 miles have been graded between Arcadia and Monroe. Orders have recently been given to push the work faster.

Wabash, St. Louis & Pacific.—Notice is given that holders of Illinois & Southern Iowa first-mortgage bonds, due Aug. 1, will have the option of extending them for 30 years from that date, at 6 per cent. interest. Bondholders desiring to have their bonds extended, must notify O. D. Ashley, Second Secretary, by July 20, and present the bonds at the Metropolitan National Bank, New York, to be stamped and have new coupons attached.

Wilmington & Weldon.—The Scotland Neck Branch, on which track was laid some months ago, has been finally completed and turned over by the contractors. It extends from Halifax, N. C., southeast to Scotland Neck, 19 miles.

ANNUAL REPORTS.

The following is an index to the annual reports of railroad companies which have been reviewed in previous numbers of the present volume of the *Railroad Gazette:*

Chicago, Rock Island & Pacific.

The report of this company shows the mileage worked at the close of the last fiscal year, March 31, 1882, as follows:

	Miles.
Main Line, Chicago to Council Bluffs	500
Kansas " Davenport, Iowa, to Atchison, Kan	345
Leavenworth Br., Atchison Junc. to Leavenworth, Kan	21.5
*Kansas City Line, Cameron, Mo., to Kansas City	54
Oskaloosa Branch. Washington, Iowa, to Knoxville	77.5
*Peoria " Bureu Junc. to Peoria	46.5
Branch Line, South Englewood to South Chicago	7.5
Branch " Wilton to Muscatine	12.5
Branch " Newton to Munroe	17.5
Branch " Des Moines to Indianola and Winterset	48.1
Branch " Menloe to Guthrie	14.6
Branch " Atlantic to Audubon	25.5
Branch " Atlantic to Griswold	14.6
Branch " Avoca to Harlan	12
Branch " Avoca to Carson	17.5
*Branch " Keokuk to Des Moines	162.2
Branch " Mt. Zion to Keosauqua	4 5
Total	1381.0

* Leased lines.

During the year the mileage of roads owned by the company has been increased 26.4 miles by the completion of the River line from Davenport to Muscatine, making a total of 1,381 miles operated at close of fiscal year; but as this new line was not opened for traffic until Nov. 6, the *average* mileage operated for the year was 1,365 miles, an increase of less than 1 per cent. The Company owns 1,128¼ miles, and leases 252½ miles. The road is located in the different states, as follows: 236 miles in Illinois; 920 miles in Iowa; 223 miles in Missouri, and 2 miles in Kansas. There are 115 miles of second track and 248 miles of sidings.

The equipment consists of 296 locomotives; 117 passenger, 17 sleeping, 6 dining, 8 postal and 39 baggage, mail and express cars; 4,404 b x, 1,083 stock, 1,825 flat and coal, and 187 caboose cars; 2 officers' and pay-cars, and 666 service cars, including hand cars.

The general account is as follows:

Liabilities.

Capital stock $50,000; amount issued		$41,959,800.00
Fractional scrip outsanding, convertible into stock		200.00
Six per cent. mortgage coupon bonds $727,270,000		
Six per cent. mortgage registered bonds	5,230,000	
		12,500,000.00
Chicago & Southwestern bonds guaranteed		5,000,000.00
Addition and improvement account		4,500,000.00
Suspense account		8,913.37
Profit balance of income account		290,084.89
Total		$64,258,998.26

Assets.

Cost of road and equipment, including all branch roads owned	$56,871,850.90
Cost of railroad bridge at Rock Island	758,526.10
Capital stock and bonds of connecting roads	2,542,497.97
Six per cent. Chicago, Rock Island & Pacific bonds	2,500,000.00
Loans payable on demand and cash in New York	1,156,838.40
Due from Post-office Department	49,998.81
Stock of material, fuel, etc., on hand	212,498.00
Cash and balances due from other roads in hands of Local Treasurer, Chicago	166,788.08
Total	$64,258,998.26

There was no change during the year in the amount of stock or bonds outstanding.

The Land Department reports sales of 64,078 acres for $617,934.91, an average of $9.64 per acre. The net cash remitted to the Treasurer during the year was $650,000. At the close of the year there were $1,594,637.27 land notes on hand.

The earnings for the year were as follows:

	1881-82.	1880-81.	Inc. or Dec.	P. c.
Passengers	$2,853,331	$2,500,135	I. $353,196	14.1
Freight	9,687,097	8,690,480	I. 996,617	11.5
Mail	215,217	188,914	I. 26,303	13.9
Express	140,400	133,394	I. 7,006	5.3
Rents, etc.	260,527	341,798	D. 81,271	23.8
Car mileage	97,038	92,363	I. 4,675	5.1
Telegraph	13,033	9,824	I. 3,209	32.7
Total	$13,266,643	$11,956,908	I $1,309,735	11.0
Expenses	7,322,802	6,630,155	I. 692,707	10.4
Net earnings	$ 5,943,781	$ 5,326,753	I. 617,028	11.6
Gross earn. per mile	9,719	8,930	I. 789	8.8
Net " "	4,354	3,978	I. 376	9.5
Per cent of exps	75.20	55.45	D. 0.25	....

Expenses include taxes, which were $332,796 last year, and $288,873 the previous year.

The average number of men employed on the road was 8,627, the largest number in any month being 9,369 in October, and the smallest 7,798 in January.

The result of the year was as follows:

Net earnings, as above	$5,943,780.53
Cash received from Land Department	659,000.00
Total	$6,593,780.53
Int rest	$ 950,000.00
Rentals	327,593.54
Tolls, Missouri River bridges	125,317.12
Dividends, 7 per cent	2,937,186.00
Appropriated for additions and improvements	2,215,000,00
	6,555,096.66
Balance	$ 38,683.87
Sale of bonds held by sinking fund	13,200,00
Balance, April 1, 1881	238,201,02
Balance, April 1, 1882	$290,084.89

The amount expended on improvements ast year was $1,403,246.69. The amount appropriated from the year's earnings is to be expended during the current year.

The traffic for the year was as follows:

Train miles:	1881-2	1880-1	Inc. or Dec.	P. c.
Passenger	2,007,226	1,890,217	I. 117,009	6.2
Freight	7,216,452	1,844,806	I. 371,646	5.4
Service	746,745	704,657	I. 42,088	6.0
Total	9,970,423	9,439,680	I. 530,743	5.6
Car miles:				
Passenger	10,850,048	9,027,072	I. 1,222,966	12.7
Freight	101,134,964	98,424,800	I. 2,710,164	2.8
Service	3,103,301	3,406,128	D. 302,827	8.9
Passengers carried	2,636,258	2,085,605	I. 550,653	26.4
Passenger miles	113,894,522	93,769,305	I. 20,125,217	21.5
Tons freight carried	3,754,532	3,376,260	I. 378,272	11.2
Ton miles	756,051,981	712,383,129	I. 43,668,852	6.1
Av. train load:				
Passengers, No	56	45	I. 11	24.4
Freight, tons	105	104	I. 1	0.9
Av. receipt:				
Per pass. mile	2.505 cts.	2,666 cts.	D. 0.161 ct.	6.0
Per ton, mile	1,280 cts.	1,220 cts.	I. 0.060 ct.	4.9

The average cost per passage and per ton per mile (counting one passenger-mile as equal to a ton-mile) was 0.811 cent last year, against 0.789 cent the previous year.

The receipts per passenger train mile were $1.60, and per freight train mile $1.34; the average cost per mile, all trains, was 73⅛ cents.

There were 326,198 tons of freight carried; 32,414,893 miles for the company's use, and not included in the statements above.

A comparison showing the growth of traffic and the decrease in rates during the past twelve years is as follows:

	1882.	1871.	Inc. or Dec.	P. c.
Passenger-miles	113,894,522	44,609,479	I. 69,285,043	155.3
Rate	2.505 cts.	3.840 cts.	D. 1.335 cts.	34.8
Ton-miles	788,466,874	151,864,519	I. 636,602,355	419.2
Rate	1.280 cts.	2.640 cts.	D. 1.360 cts.	51.5

Last year's traffic was the largest ever carried over the road.

During the year 7,750 tons of steel were used in replacing iron rails, and 2,444 tons in new tracks.

The second track was extended 15½ miles, and work began on its further extension to Bureau Junction, 114 miles from Chicago, this year.

A large amount of work was done on new buildings, the most important being an elevator of 1,500,000 bushels capacity, an addition to the freight house and a new car shop, all in Chicago.

There were 3,170 ft. of iron bridge built to replace wood, and a large amount of new masonry built.

Six old engines were replaced by new and heavier ones. There were added to the equipment 6 engines; 15 passenger, 2 sleeping, 3 postal and 3 baggage cars; 170 box, 200 stock, 201 flat and 4 caboose cars. These were all built in the shops except the sleeping cars and 200 flat cars.

The charges to construction and equipment were as follows:

New road	$185,396.07
Second track	287,131.13
Chicago elevator	161,075.45
Other improvements of road	338,413.79
New equipment	431,230.25
Total	$1,403,246.69

The President's report says: "It is in contemplation to renew several wooden bridges with more permanent structures during the coming season.

"To continue the work of reducing the heavy grades on the Southwestern Division, at the same time replacing the timber trestles with stone or iron bridges and embankments.

"To extend one of the branch railroads a distance of six miles to a connection with a railroad already constructed, and to continue to ballast with stone and gravel.

"The work thus indicated, together with such additions to the equipment as the traffic may seem to demand, it is estimated may call for an expenditure, the coming year, of one million of dollars, properly chargeable to additions and improvements.

"It is hoped the revenue of the road will continue ample, not only to provide for the interest charges, dividends and rentals, but also to furnish means to discharge the obligations incurred in improving and perfecting the road to a standard not excelled by any of its competitors.

"At the same time the board of directors are not unmindful of the fact that the past two years have been exceptionally favorable to large railway earnings; that the surplus of agricultural products now awaiting shipment are less than an average quantity; that increased competition from new lines of railway now being constructed may be anticipated; and that a combination of the above with possible short crops and other causes may result in somewhat reduced earnings for the next fiscal year.

"It is proper to state for the information of stockholders, a very large majority of whom are non-residents of the states in which this railway is located, that while there has been no new special or general legislation during the past year that materially affects the interest of your railway, the Board of Railway Commissioners for the state of Illinois, acting under a resolution of the last General Assembly, published a revised schedule of reasonable maximum rates (so called) to take effect from and after Dec. 1, 1881. As the freight rates thus prescribed average from 20 to 30 per cent. lower than those in effect prior to December, 1881, and are stated by the Commissioners in their annual report to be from 25 to 33 per cent. less than rates established by legislation in the adjoining states of Wisconsin and Missouri, it would look as if the interests of the producer and shipper had not been lost sight of.

"Whether the increased volume of traffic under the stimulus of lower rates will insure railroads equal revenue is a matter of doubt, and remains to be proved, the lesser rates not having been operative long enough to determine results.

"Your managers, acting under advice of legal counsel, have deemed it the wiser policy to adopt the revised schedules of rates as the basis for freight charges in Illinois, and to work so far as practicable in harmony with the views expressed by the boards of railroad commissioners of the various states, or at least so far as to avoid friction with the legally constituted state authorities.

"During the last months of the fiscal year a considerable traffic destined to and from Minnesota, Dakota and Manitoba has passed over our line, which, in connection with the Burlington, Cedar Rapids & Northern and Minneapolis & St. Louis railways, form a continuous line from Chicago to Minneapolis.

"While the distance is somewhat greater than *via* other lines between the above named cities, the advantage of connecting with the eastern roads outside of the city limits of Chicago, thus avoiding a tedious and expensive transfer through the city, goes far toward nullifying the advantage of shorter distance possessed by other roads. For instance, the Rock Island road makes connection and transfers with Lake Shore and Pennsylvania railroads at Englewood, 6½ miles from Chicago; with the Pittsburgh, Cincinnati & St. Louis Railway at Washington Heights, 12 miles out; with Grand Trunk Railway, 17 miles west of Chicago; with the Michigan Central *via* Cut-off line at Joliet, 40 miles, and with the Cincinnati, Indianapolis, St. Louis & Chicago Railway by their new line at Seneca, 70 miles west of Chicago. It will readily be seen that Eastern lines will gladly avoid hauling cars into Chicago, often crowding their yards, to the great delay and detriment of other traffic, when they can transfer passengers and freight destined for the West and Northwest to the Chicago, Rock Island & Pacific Railway entirely outside the city.

"It is also apparent that this company's road already possesses in a large degree the advantages promised by the advocates and projectors of the various belt railways.

"As the traffic for the Northwest passing over the Albert Lea Route—so called—is hauled over 222 miles of this company's road, comprising the entire Illinois Division, with its low grades and double track, and delivered to the connecting line without breaking bulk, it is manifest that there is a fair margin of profit in doing this business at even less rates than possible on other portions of the road.

"It is confidently expected that hereafter no inconsiderable portion of the company's revenue will be derived from that vast and rapidly developing territory in the Northwest, reached by the Northern Pacific and Manitoba Railways, inaccessible to this company until recently.

"By the construction of a new line of railway, known as the Kankakee & Seneca Railroad, connecting with this company's road at Seneca station, 70 miles west of Chicago, a shorter and more direct route is opened from Central and Southern Ohio and Indiana to all points on our line west of Seneca. This new road, 42 miles in length, was opened for traffic in January, and has been operated by the Cincinnati, Indianapolis, St. Louis & Chicago Railway Company, trains running in close connection with through trains to and from Cincinnati *via* Indianapolis and LaFayette, Ind.

"Through a traffic arrangement made with the above-named company, passengers and freight for the West and Northwest are delivered and received at the connecting point with this road, thus saving in time and distance; and it is believed that important advantages in the future may be expected from this connection."

Chesapeake & Ohio Canal.

This company owns a canal from Cumberland, Md., to Georgetown, D. C., 184.5 miles, with a branch from Georgetown to Alexandria, Va., 7 miles. Almost its entire business is carrying coal from the Cumberland Region to tidewater. The controlling interest is held by the state of Maryland, nearly all the rest of the stock by the cities of Washington, Georgetown and Alexandria and the United States.

The earnings for the year ending Dec. 31 were as follows:

	1881.	1880.	Inc. or Dec.	P. c.
Gross earnings	$308,838	$372,616	D. $63,778	17.1
Expenses	241,757	227,277	I. 14,480	6.4
Net earnings	$67,081	$145,339	D. $78,258	54.0
Per cent. of exps	78.2	60.9	I. 17.3	....

The two principal causes for the decrease are: First, failure of George's Creek & Cumberland road to give access to the canal basins until July, and, second, the drought that reduced the supply of water. The draft of boats was reduced and navigation was suspended for some days. Tightening of dams, necessitated by the drought, increased the expenses.

In addition to the ordinary expenses there were paid for law expenses, $4,323.96; purchase of basin wharf property, $15,000; for interest on notes, basin property, temporary loans and coupons on repair bonds, $13,694.94; judgment of commissioners of Allegany County, $3,763.89. The net revenue over all debts contracted other then lengthening locks during the year has been $30,398.20.

The income account was as follows:

Balance from 1880	$42,831.38
Receipts from canal	305,096.82
Sale of repair bonds	37,000.00
Temporary loans	40,000.00
Total	$424,928.20
Labor and materials	$73,716.62
Interest on repair bonds	7,080.00
Other interest, lands, working expenses, etc.	228,554.40
Extending locks	69,038.43
	378,389.45
Balance on hand	$45,538.75

In relation to repairs of canals for the flood of 1877 the liabilities are: Sale of repair bonds, $134,000; loan from Farmers' & Merchants' National Bank of Baltimore, $25,000; loan from Alex. Brown & Sons, $15,000; due to contractors and laborers, $43,885.74—total, $207,885.74. The assets Dec. 31, 1881, were: Cash in bank and in hands of accounting officers, $45,638.75; due from coal companies on account of tolls, $28,073.73. Of the cash on hand $16,500 is attached in the Farmers' and Merchants' National Bank of Baltimore; the $28,073 73 of uncollected dues cannot be collected until after the determination of suit which has been instituted and which is now pending in the Circuit Court for Allegany County.

Of the 227 locks for which materials have been contracted for 14 locks have been completed, and the company have a considerable quantity of material on hand. The cost of labor and material in 1881 was $83,648.84. All of this was paid except $13,710.41. In 1878 the company purchased from Walsh & McKaig the property known as the basin and wharf property, at Cumberland, for $100,000. On this $59,000 have been paid. The works of the canal were kept in good condition during the year. Immediately after the suspension of navigation in December last the water was drawn from the canal and the work of lengthening the locks was vigorously prosecuted. On April 6 water was turned in the canal, but prior to that time a strike was inaugurated in the Cumberland region, which still continues, so that up to this time the canal has been virtually without trade. This necessitated, as far as possible, a total suspension of all repairs and improvements. The disastrous effect of the strike upon the canal is too well known to speak of it.

It is noted with pleasure the completion of the West Virginia Central & Pittsburgh road from near Bloomington, on the Baltimore & Ohio road, to the Elk Garden coal field, a distance of nearly 13 miles, and the opening of the mines at Elk Garden from which there is now being shipped about 800 tons per day. The road is being rapidly extended as far as the Fairfax Stone, with a probability of its being completed to that point during the present year. This immense coal-field will make it one of the largest coal carriers east of the Alleghanies, and it will be a feeder of the canal, from which it will derive a very considerable trade.

The indebtedness of the company on May 1 was: To the Farmers' & Merchants' National Bank of Baltimore, for temporary loans, $2,500; repair bonds of 1878 on deposit, $100,000; loan from Alex. Brown & Sons, $15,000; loans deposited, $50,000; loan Second National Bank, Cumberland, Md., $10,000; bonds deposited, $20,000. The balance of the repair bonds of 1878 are in the hands of the Safe Deposit Company in Baltimore.

Montpelier & Wells River.

This company owns a railroad from Wells River, Vt., to Montpelier, 38 miles. Its last report covers a period of 15 months, from Jan. 1, 1881, to March 31, 1882, the fiscal year having been changed, to end with March instead of December.

The equipment consists of 3 engines; 4 passenger, 1 combination and 2 baggage cars; 53 freight cars and 1 caboose; 1 derrick car and 1 snow-plow.

The company has no bonded debt. There is a floating debt, incurred for purchase of real estate and equipment, on which $12,004.23 were paid last year, leaving $42,868.34 due March 31.

The earnings, etc., for the 15 months were as follows:

Freight	$68,713.68
Passengers	27,418.70
Other sources	19,716.60
Total ($3,048.63 per mile)	$115,847.98
Expenses (79.78 per cent.)	92,426.84
Net earnings ($616.35 per mile)	$23,421.14
Surplus from previous year	9,094.47
Total	$32,515.61
Real estate	$2,557.50
Interest on equipment debt	3,633.26
Principal " "	12,004.23
	18,194.99
Surplus, March 31, 1882	$14,320.62

There were laid 260 tons steel rails and 13,303 new ties. Part of the road has been new ballasted and some new sidings have been built. Several bridges have been renewed and the buildings repaired and painted.

Land has been bought for the enlargement of the Montpelier yard. A building was also bought in Montpelier which is now used for a passenger station and general offices. The equipment has been kept in good condition.